COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF INTERNAL AFFAIRS

GROUND-WATER RESOURCES

OF

BEAVER COUNTY
PENNSYLVANIA

By

D. W. Van Tuyl and N. H. Klein

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D. W. VAN TUYL and N. H. KLEIN
U. S. Geological Survey

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GROUND-WATER RESOURCES OF BEAVER COUNTY, PENNSYLVANIA[1]

BY

D. W. Van Tuyl[2] and N. H. Klein[3]

ABSTRACT

This report describes the ground-water resources of Beaver County in western Pennsylvania. It is an extension and continuation of the investigation reported in "Ground water in northwestern Pennsylvania," by R. M. Leggette, published in 1936. The present report covers in more detail the general data of the earlier report; in addition there are cross sections showing the thickness and occurrence of the glacial-outwash gravels along the principal streams of Beaver County. Included in the report are records of all industrial and municipal wells and ground-water use in the county as of 1948.

Beaver County is part of the important industrial area of western Pennsylvania. It is bounded by Washington County to the south, Allegheny County to the southeast, Butler County to the east, Lawrence County to the north, and by the Ohio-Pennsylvania State Line to the west. It has a population of 175,000 of which about 50,000 are directly employed in the manufacturing industries. Large quantities of ground water are needed to supply the inhabitants and industries of the county. The chief uses are for municipal supply and industrial cooling. Air-conditioning use is not large at the present time.

The most important source of ground water is the alluvium that partly fills the valleys of the Ohio and Beaver Rivers. The sediments in the Ohio Valley in Beaver County are as much as 130 feet thick. The water-bearing sands and gravels are continuous along the valley and constitute the chief source of ground water in the county. The Beaver River in Beaver County flows in a steep-sided valley in which water-bearing sands and gravels occur only at the mouth and in a few isolated segments along its course. Although potentially a good area in some localities, the Beaver Valley is not now heavily utilized as a source of ground water.

Additional ground-water supplies in Beaver County can be developed, especially along the Ohio River. Present municipal pumpage, averaging 7.6 million gallons a day, probably can be increased substantially by new wells in existing well fields. Industrial use of ground water, now about 15 million gallons a day, can be increased several times by tapping the valley sediments in new locations having favorable geologic and hydrologic conditions for inducing recharge from the river. The Beaver River valley near the Ohio River appears to be favorable for the development of additional ground water. Likewise, a buried-valley area near Darlington in the northwest part of the county may be suitable for greater development from properly located wells.

Analyses of the chemical quality of water obtained from wells in the valley sediments indicate that the water is generally hard and high in iron. Prominent concentrations of sulfate occur in the water from some wells. The relatively wide range in the chemical character of the well water is due in part to the degree in which recharge from the rivers is effective at various well locations.

[1] Publication authorized by the Director, U. S. Geological Survey. The stratigraphic nomenclature used in this report is that of the Pennsylvania Topographic and Geologic Survey and does not necessarily conform to the standard usage of the U. S. Geological Survey.

[2] Hydraulic Engineer, U. S. Geological Survey.

[3] Scientific Aid, U. S. Geological Survey.

INTRODUCTION

PURPOSE OF REPORT

This is one of a series of reports designed to provide ground-water information for the Commonwealth of Pennsylvania systematically by counties. The first report , "Ground-water resources of the valley-fill deposits of Allegheny County, Pa.," by Adamson, Graham, and Klein (1949)[4] was published as Bulletin W 8 of the Pennsylvania Topographic and Geologic Survey. The present report describes the geology and ground-water resources of Beaver County, which lies northwest of Allegheny County. This series of county reports is intended to contain the results of continuing ground-water investigations, which were started in 1925, by the United States Geological Survey in cooperation with the Pennsylvania Topographic and Geologic Survey.

This report supplements the information on the ground-water resources of Beaver County contained in Bulletin W 3, entitled "Ground water in northwestern Pennsylvania" (Leggette, 1936). Industrial and municipal ground-water supplies have been tabulated with respect to quantity and quality, especially as they occur along the principal valley-fill areas and near the larger population centers. In addition, data are given pertaining to the location, size, depth, and yield of all large wells in the county. Cross sections and maps of the valley sediments, water-level fluctuations, and temperature records are presented. The hydraulic characteristics of the water-bearing gravels at the Ambridge well field, as determined by pumping tests, are described.

This study was made under the general supervision of A. N. Sayre, Chief, Ground Water Branch, U. S. Geological Survey. The cooperative ground-water program in Pennsylvania is under the immediate supervision of J. B. Graham, U. S. Geological Survey.

PREVIOUS STUDIES

A number of geologic reports describe in whole or in part the ground water and mineral resources of Beaver County. Chief among these are folio reports by Woolsey (1905), Munn (1911), and an atlas report by DeWolf (1929). The glacial deposits and Pleistocene history of the area have been described by Leverett (1902).

A series of reconnaissance ground-water reports, Bulletins W 1 to W 7 of the Pennsylvania Geological Survey, Fourth Series, was published between 1933 and 1941, describing the ground-water resources of the Commonwealth by regions (Piper, 1933), (Hall, 1934), (Leggette, 1936), and (Lohman, 1937, 1938, and 1939). This series of reports describes in general the geology and ground-water resources of each county, but does not contain complete descriptions of the occurrence and utilization of municipal and industrial ground-water supplies. Bulletin W 3 (Leggette, 1936), which covers an area including Beaver County, contains a table of 42 drilled wells and a table of 23 public water supplies located in the county. Records of existing municipal and industrial wells listed in Bulletin W 3 are included in this report.

[4] See page 36 for list of references cited.

PRESENT INVESTIGATION

The field work for this report was begun in June 1947 and was continued during 1948 and part of 1949. A survey including municipalities, major industries, well drillers, engineering firms, and numerous individuals was conducted in gathering the well data forming the basis for the report. The wells inventoried during this investigation are shown on a county map (pl. 1). Drillers' logs, chemical analyses, static water levels, pumping levels, drawdowns, and records of pump discharge were obtained in addition to many other data in connection with ground-water use. An automatic water-stage recorder was installed during 1949 at Darlington in the northwestern part of the county for measurement of ground-water fluctuations.

Geologic sections showing valley sediments were prepared from records of borings for bridges, dams, and highway relocations.

A controlled pumping test was made in the present municipal well field at Ambridge in 1949 to determine the water-bearing characteristics of the local sand and gravel aquifer and the extent of hydraulic connection with the Ohio River.

ACKNOWLEDGMENTS

Initial field work and compilation of records was done by J. H. Adamson, Jr. The base map of the county was prepared by the Pittsburgh office of the Pennsylvania Topographic and Geologic Survey under the direction of A. I. Ingham. Numerous maps, boring plans, and other valuable data were furnished by the Corps of Engineers, Department of the Army, the Pennsylvania Railroad, the Pittsburgh and Lake Erie Railroad, and by the County Commissioners of Beaver County.

Chief contributors of water-well records were the Pennsylvania Drilling Co., the Ohio Drilling Co., the Layne-New York Co., and the Gilkey Bros. Drilling Co. Many individuals, particularly J. Z. Columbia, Borough of Ambridge, and E. V. Grimshaw, Woodlawn Water Co., cooperated by furnishing chemical analyses and water-use records.

The authors gratefully acknowledge the assistance and critical review of the report by S. H. Cathcart and R. C. Stephenson of the Pennsylvania Topographic and Geologic Survey.

GEOGRAPHY

SURFACE FEATURES AND DRAINAGE

Beaver County, 441 square miles in area, lies entirely within the Allegheny Plateau physiographic province. The land surface has been highly dissected by erosion of the two principal streams and the many small tributaries. The maximum relief is 680 feet. The lowest altitude, 720 feet, occurs where the Ohio River crosses the western border of the county, and the highest altitude, 1,360 feet, is about 1 mile southwest of Midland. Beaver County has very little flat land, except for the terraces and flood plains of the Ohio and Beaver Rivers and Little Beaver Creek. The

Ohio and Beaver Rivers and their tributaries drain the county (pl. 1). The Ohio River enters the county at Ambridge on the southeast border and flows northward as far as Rochester. Here it turns and flows southwestward leaving the county and the State 3 miles west of Midland. The gradient of the river through the county is about 1.1 feet per mile. The Beaver River flows southward from the northern boundary of the county and joins the Ohio River at Rochester. Raccoon Creek follows a meandering course northward, entering the Ohio 4.5 miles downstream from Rochester. Connoquenessing Creek, entering from Butler County on the east, flows through the northeastern part of the county into Lawrence County and joins the Beaver River at the county boundary. The North Branch of Little Beaver Creek flows southwestward from New Galilee through a broad preglacial valley in the northwestern section of the county.

CLIMATE

The mean annual air temperature at Midland in the western part of the county is 51.9° F., based on an 11-year period of record. The mean recorded at Pittsburgh, 28 miles southeast, is 52.6° F. for 76 years of record, and the mean at New Castle, 28 miles northeast, is 50.2° F. for 65 years of record. The mean temperature range for the 11-year period at Midland was 42.2° F., varying from 30.6° F. in January to 72.8° F. in July.

The average annual precipitation at Midland (1937-49) is 38.25 inches varying from a maximum of 4.39 inches in May to a minimum of 2.21 inches in February. At Beaver Falls, 10 miles northeast of Midland, the average annual precipitation for the same period is 35.63 inches, varying from 4.25 inches in June to 2.16 inches in December. The average annual precipitation for the State (1888-1949) is 42.06 inches.

MINERAL RESOURCES

Beaver County is an important source of many minerals. Clay is mined extensively in the area north of the Ohio River and in the vicinity of Monaca. The principal commercial clays are the Upper Freeport clay (see table 1), 3 to 5 feet thick; Lower Freeport clay, 3 to 5 feet thick; Middle Kittanning clay, 4 feet thick; and Lower Kittanning clay, 1 to 11 feet thick. Of these, the Lower Kittanning is the bed that is principally mined, and it crops out conveniently low in the hills along the Ohio and lower Beaver Rivers. This bed generally contains 4 to 6 feet of good plastic clay. In the northern part of the county, the gray to buff Homewood sandstone is quarried. The Vanport limestone is extensively quarried and mined in the same area. Sand and gravel are obtained by dredging from rivers and by digging in glacial deposits.

Although Beaver County lies somewhat west of the principal bituminous coal-producing areas, the production from 13 mines in 1945 was 325,000 tons, making it the nineteenth in rank in the State. Production of coal reached its peak in the county in 1941 when nearly one million tons was mined. The most important coal bed is the Upper Freeport coal, averaging 3 to 4 feet thick and attaining a maximum thickness of 7½ feet. The other coal beds mined in the county are generally less than 3 feet thick. These

include the Lower Freeport and the Upper, Middle, and Lower Kittanning coals. Estimated recoverable reserves in the county, of seams more than 3 feet thick, amount to about 70 million tons.

Oil was discovered in the western part of the county at Smiths Ferry in 1860, the year following Colonel Drake's discovery at Titusville in Crawford County. Production in recent years has ranged between 30 and 40 thousand barrels annually. The western and southeastern sections of the county are the principal areas of production. Most of the oil has come from the Berea sand of Lower Mississippian age. Economically recoverable reserves of oil in the ground in 1941 were estimated at 8.4 million barrels underlying a land area of about 18 square miles. Natural gas also has been produced in the county for many years. The production in 1942 was 107 million cubic feet.

INDUSTRY

Beaver County lies wholly within the area known as the Pittsburgh Metropolitan Area (defined by the Bureau of Census as consisting of the counties of Allegheny, Beaver, Washington, and Westmoreland) and is one of the most highly industrialized counties in the State. The county ranked fifth in Pennsylvania in 1945 in manufactured products, valued at $420,000,000. The major commercial and industrial concerns are located for the most part along the principal river valleys. Metals and metal products account for more than 76 per cent of the value of manufactured items. Sixty-four plants were in this classification in 1945, including such large corporations as the American Bridge Co., Crucible Steel Co. of America, National Electric Products Corp., Babcock & Wilcox Tube Co., Jones & Laughlin Steel Co., National Supply Co., A. M. Byers Co., and St. Joseph Lead Co. Chief products of these concerns are iron and steel bars, electrical machinery, pipes and tubing, iron and steel plates, shipbuilding, and lead and zinc metals. The county ranked third in the State in the value, $321,300,000, of its metal products in 1945.

Next in importance in Beaver County are chemicals and allied products. Twelve plants are in this classification, including the Koppers Company, Inc., and Freedom-Valvoline Oil Co. The county ranks ninth in the State in this category.

Clay, glass, and stone make up the remainder of the principal industries in the county and the value of their combined products in 1945 was in excess of $8,000,000. There are 30 such plants in the county, making it eighth in rank in the State in this classification. Pottery and chinaware, bricks, terra cotta and fire clay, lamps, chimneys, and reflectors are the chief types of products. Employment statistics for 1947 showed 52,603 persons employed with total monthly earnings averaging $11,378,360.

POPULATION

According to the Federal census of 1940, the population of Beaver County was 156,754, making it the nineteenth largest in Pennsylvania. The estimate in 1950 was approximately 175,000. The density of population in 1940 was 355.5 persons per square mile compared to the State average of 219.8. The largest boroughs in the county are Aliquippa with

31,100, Ambridge with 24,900, and Beaver Falls with 21,300. Other towns having populations greater than 5,000 are New Brighton, Rochester, Monaca, Midland, and Beaver, the county seat. The county population is roughly divided into 65 per cent urban and 35 per cent rural. All the above towns and cities lie along the Ohio River and the Beaver River valleys.

There are 26 boroughs, 3 first-class townships, and 23 second-class townships in Beaver County. In 1940 there were 2,047 farms and 65,000 acres of land under cultivation, representing about 23 per cent of the total land area.

TRANSPORTATION

Three major railroad systems serve the county, the Pennsylvania Railroad, the Pittsburgh and Lake Erie Railroad, and the Baltimore and Ohio Railroad. The railroads are located principally along the river valleys. Barge traffic on the Ohio River provides economical transportation of raw materials and finished products to and from the factories and towns. There are 600 miles of highways in the county, of which 482 miles are improved. Commercial air transportation is easily accessible in adjoining Allegheny County. In 1945 about 21,000 passenger cars and 3,750 commercial vehicles were registered in the county.

GEOLOGY

STRATIGRAPHY

The geology of the exposed rocks of Beaver County is relatively simple, as shown on Plate 1. The consolidated rocks exposed in the county range stratigraphically from about 50 feet above the Pittsburgh coal of the Monongahela group down through about 200 feet of the Pottsville series (table 1).[5] Although there is a slight regional dip to the southeast, stream dissection has been the principal factor in exposing the consolidated rocks. Thus, the oldest rocks crop out in a narrow band in Beaver Valley north from about New Brighton, and also along the lower part of Connoquenessing Creek. Rocks of the Allegheny group crop out along the sides of the stream valleys, the successively younger units of the group being exposed to the south and southeast. The coals and thin limestone units form good horizon markers in the county.

The Conemaugh group crops out over most of the southern two-thirds of the county and in the highest land in the northern one-third. The group has the greatest area of exposure of any in the county.

Exposures of the Monongahela group are restricted to only the tops of the highest hills or knobs in the southern part of the county.

[5] The United States Geological Survey classifies the Pennsylvanian as a series of the Carboniferous system, and the Monongahela, Conemaugh, Allegheny, and Pottsville as formations of the Pennsylvanian series.

TABLE 1. *Stratigraphic sequence of rocks in Beaver County.*

SYSTEM	SERIES	GROUP	MEMBER
Quaternary			
	Recent and Pleistocene		
		(Valley deposits—Recent and glacial outwash)	
		(Terrace deposits—early glacial outwash and Carmichaels formation)	
Pennsylvanian			
	Upper Pennsylvanian		
		Monongahela	
			Pittsburgh sandstone
			Pittsburgh coal
		Conemaugh	
			Pittsburgh limestone
			Morgantown sandstone
			Elk Lick coal
			Ames limestone
			Bakerstown coal
			Brush Creek limestone
			Brush Creek coal
			Mahoning sandstone
		Allegheny	
			Upper Freeport coal, clay, and limestone
			Butler sandstone
			Lower Freeport coal, clay, and limestone
			Freeport sandstone
			Upper Kittanning coal
			Middle Kittanning coal and clay
			Lower Kittanning coal and clay
			Vanport limestone
			Clarion coal
			Brookville coal
	Pottsville		
			Homewood sandstone
			Mercer shale
			Connoquenessing sandstone

In Beaver County only a small area in the northwest, in the vicinity of Darlington and New Galilee, was covered by ice during the Pleistocene epoch (see pl. 1). No prominent terminal moraine, such as is found in other counties to the north, marks the boundary of the ice sheet. Some high-level terrace gravels remain along the present stream valleys as evidence of deposition caused by melting and retreat of the ice margins, but the deposits of these older terraces are thin and discontinuous. In the southern part of the county, along Brush and Raccoon Creeks, are sand and gravel of local origin, which are believed to have been deposited during the Pleistocene epoch along streams which were not of glacial origin. These deposits are known as the Carmichaels formation.

The valleys of the Pleistocene streams that were supplied by glacial melt water became partly filled with sand and gravel derived from glaciated areas. In Beaver County these outwash sediments are found beyond the drift border in the valleys of the Beaver and Ohio Rivers. They at-

tain a thickness of 135 feet at places in the Ohio River valley below the mouth of the Beaver River. Most of these sediments are thought to be related to the most recent Pleistocene stage, the Wisconsin.

STRUCTURE

The bedrock structure of Beaver County is characterized by a gentle regional dip, averaging 17 feet per mile, southeast toward the axis of the Pittsburgh-Huntington synclinorium, a major structural depression of southwestern Pennsylvania and adjacent West Virginia and Ohio. Superposed on the regional dip are several northeast to north trending folds. From west to east in the county these are the (1) Darlington syncline, (2) Homewood anticline, (3) West Middleton syncline, (4) Crows Run anticline, and (5) Sewickley anticline. Of these five, the Homewood anticline and West Middleton syncline are the largest structures, both extending beyond the borders of the county; the maximum amplitude of these folds is 75 feet. In addition to the structures listed above, numerous local flexures interrupt the regional dip.

GEOLOGIC HISTORY

The relative position in geologic time of the rocks of Pennsylvanian and Quaternary age occurring in Beaver County is shown in Figure 1. The consolidated rocks of Beaver County were deposited more than 200 million years ago in shallow inland seas and broad swamps which intermittently spread over western Pennsylvania during Pennsylvanian time near the end of the Paleozoic era. These deposits were folded at the close of the Paleozoic era, during the Appalachian Revolution. After this interval of folding and consequent uplifting, the area remained elevated above sea level during Mesozoic and Tertiary time, and erosion became the dominant geologic process. The history of the successive stages of erosion throughout western Pennsylvania has been interpreted chiefly from the remnants of peneplains or areas that were completely or partly reduced to a level surface. Old erosional levels are represented by flat-topped hills. Successively younger erosion stages are indicated at lower levels by terraces in the major stream valleys.

The drainage pattern in the county just prior to the ice age differed from the present system (fig. 2). A preglacial river followed the present course of the Ohio River from Pittsburgh to Beaver, then flowed northward through the present Beaver Valley to the Great Lakes. A tributary stream with its mouth at Beaver flowed eastward through the present westward course of the Ohio River. Raccoon Creek entered the main preglacial river by way of New Sheffield and Aliquippa.

The first Pleistocene ice sheet to enter Pennsylvania blocked the northward drainage and the water was ponded until an outlet across the divide to the west was formed, establishing the present westward flow of the Ohio River. When climate changes caused the ice to gradually disappear from western Pennsylvania, the rivers, swollen with melt water, transported much clay, sand, and gravel from the debris-littered glaciated areas by way of the newly formed Ohio River and its northern tributaries. Northwestern Pennsylvania was subjected to at least three separate major glaciations. The most recent, the Wisconsin, advanced as far south as

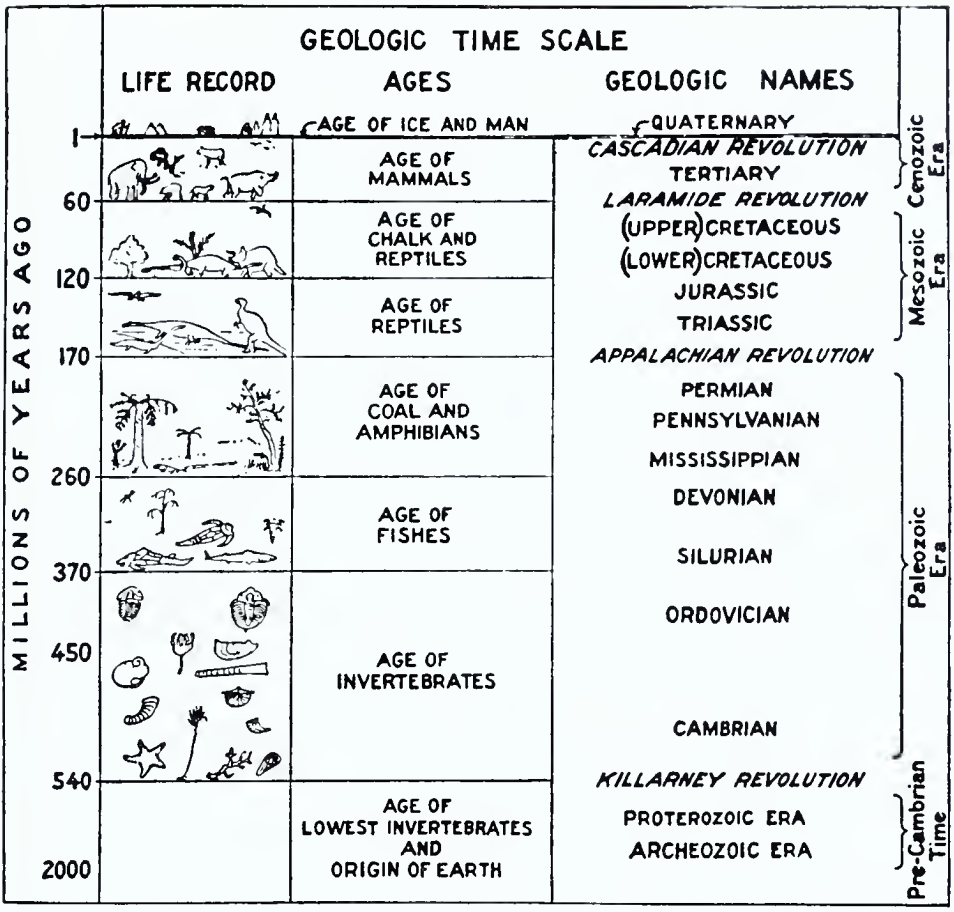

FIGURE 1. Geologic time scale (after Willard).

Beaver County, occupying about 52 square miles in the northwest corner, as shown on Plate 1. Fluvio-glacial deposits of clay, sand, and gravel accumulated in the valleys of the Ohio and Beaver Rivers during the Wisconsin stage. Since Wisconsin glaciation, the streams have built their present flood plains on these partly incised valley deposits.

GROUND WATER

PRINCIPLES OF OCCURRENCE

The source of essentially all ground water is precipitation which has fallen on the earth and seeped into the ground. It is held in the voids or pore spaces of rocks in the zone of saturation and is recovered for use through springs and wells. Ground water is a part of the earth's natural drainage and moves by gravity through the rock pores, cracks, or solution channels toward lower levels. The occurrence of ground water is determined by the geology of a region, and its storage and movement are governed by the size, shape, and interconnection of the rock openings as well as by the forces of gravity and molecular attraction.

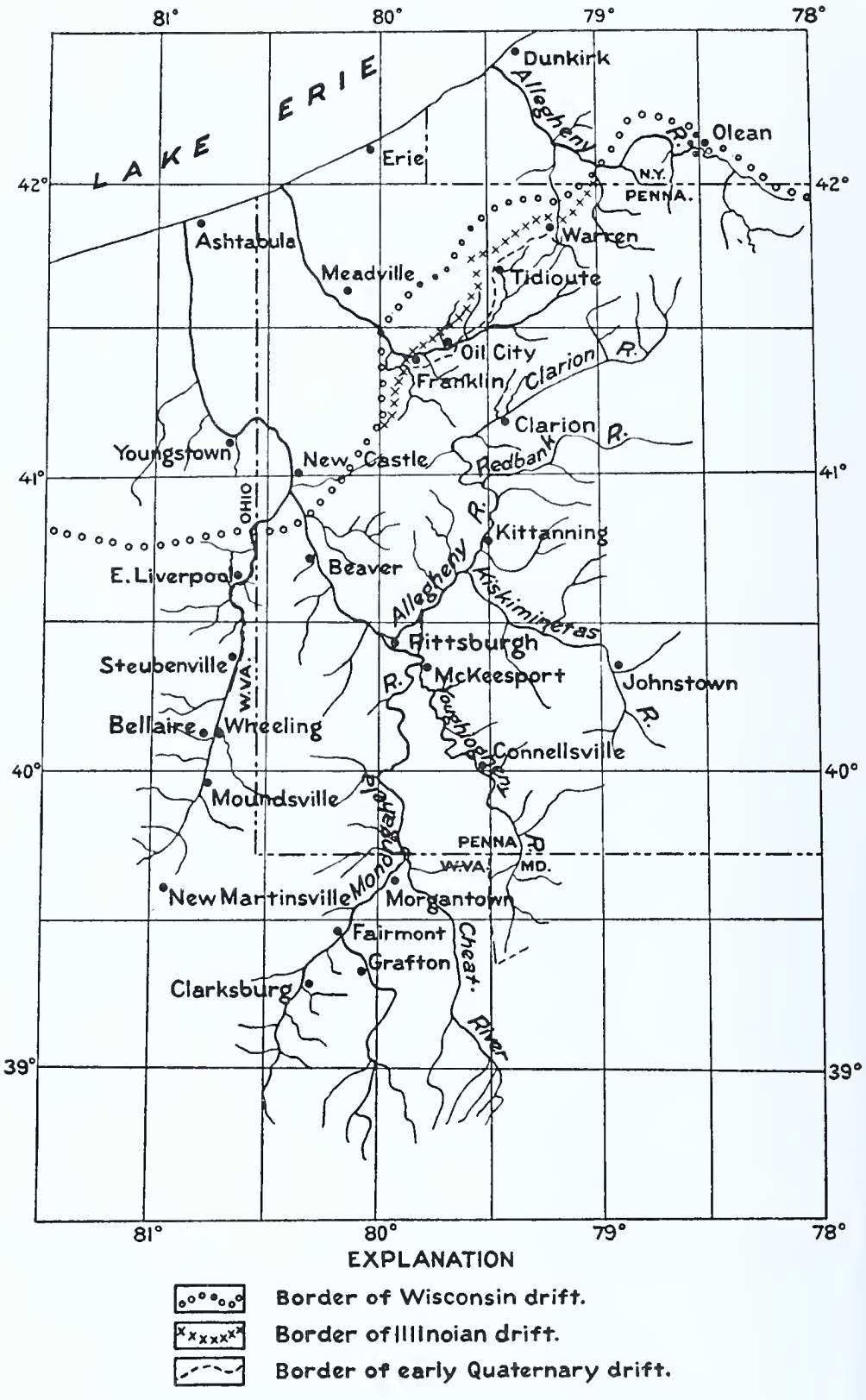

FIGURE 2. Sketch map showing probable preglacial drainage of western Pennsylvania (after Leverett).

A rock formation that yields water in quantities sufficient to make it a practical source of supply is called an *aquifer* or water-bearing formation. The amount of water that a rock contains is measured by its *porosity*, the percentage of void space to total rock mass. The amount of water that a rock will yield from storage is measured by its *coefficient of storage*. In addition to the properties of containing and yielding water from storage, a water-bearing rock must possess the property of *permeability*, or ability to transmit water. Rocks that contain large interconnected pore spaces (sand and gravel, for example) are highly permeable and will yield water freely. Rocks that contain small pore spaces (shales, limestones, and most other consolidated rocks) are relatively impermeable and will yield water very slowly, unless their permeability is increased by the presence of secondary openings such as cracks, bedding planes, and solution channels. The permeability of any rock formation ordinarily varies from place to place, either horizontally or vertically, or both. It may be decreased by cementation, incrustation, or other forms of clogging.

Ground water is said to occur under water-table conditions when it is not confined by an overlying impermeable formation. In this case, the level of water in a well (when it is first drilled) marks the upper surface of the zone of saturation, or the *water table*. Ground water confined under pressure between two impermeable strata is said to be *artesian*. It will rise in a tightly cased well above the level at which first encountered when the well was drilled, to a height determined by the amount of hydraulic pressure acting on it. The static level of artesian water is above the upper surface of the saturated formation and is called the artesian-pressure surface or *piezometric surface*. An artesian well will flow where the piezometric surface is higher than the land surface at the well.

Diagrams in Figure 3 illustrate water-table and artesian conditions. Diagram *a* shows ground water under pressure and confined between two impermeable formations. The piezometric surface is an imaginary line representing the height to which the water would rise under the existing pressure. In this illustration the pressure or head is developed at an intake area of the aquifer, at some elevation higher than the location of the diagrammatic cross section. Diagram *b* shows an unconfined system, comparable to an open channel, in which the water table is sloping toward the river and is approximately at river level. In Beaver County under water-table conditions with no pumping from wells, recharge to the water-bearing formation is by direct precipitation, by transverse surface drainage from the adjacent uplands, and by infiltration from rivers during high river stages. In areas where wells are operating, the water table is lowered and some recharge may be derived from infiltration of river water during periods of normal river stage. A semi-artesian condition would be a combination of the two conditions shown in Figure 3, in which the upper confining layer is either discontinuous or "leaky" to the extent that the water is neither completely confined nor unconfined, hydraulically.

In ground-water studies certain terms are used to describe the hydraulic properties of aquifers. The properties of transmitting and storing water are measured, respectively, by the coefficients of transmissibility and storage. The *coefficient of transmissibility* is defined as the rate of flow, in gallons a day, through each vertical 1-foot strip of aquifer under a hy-

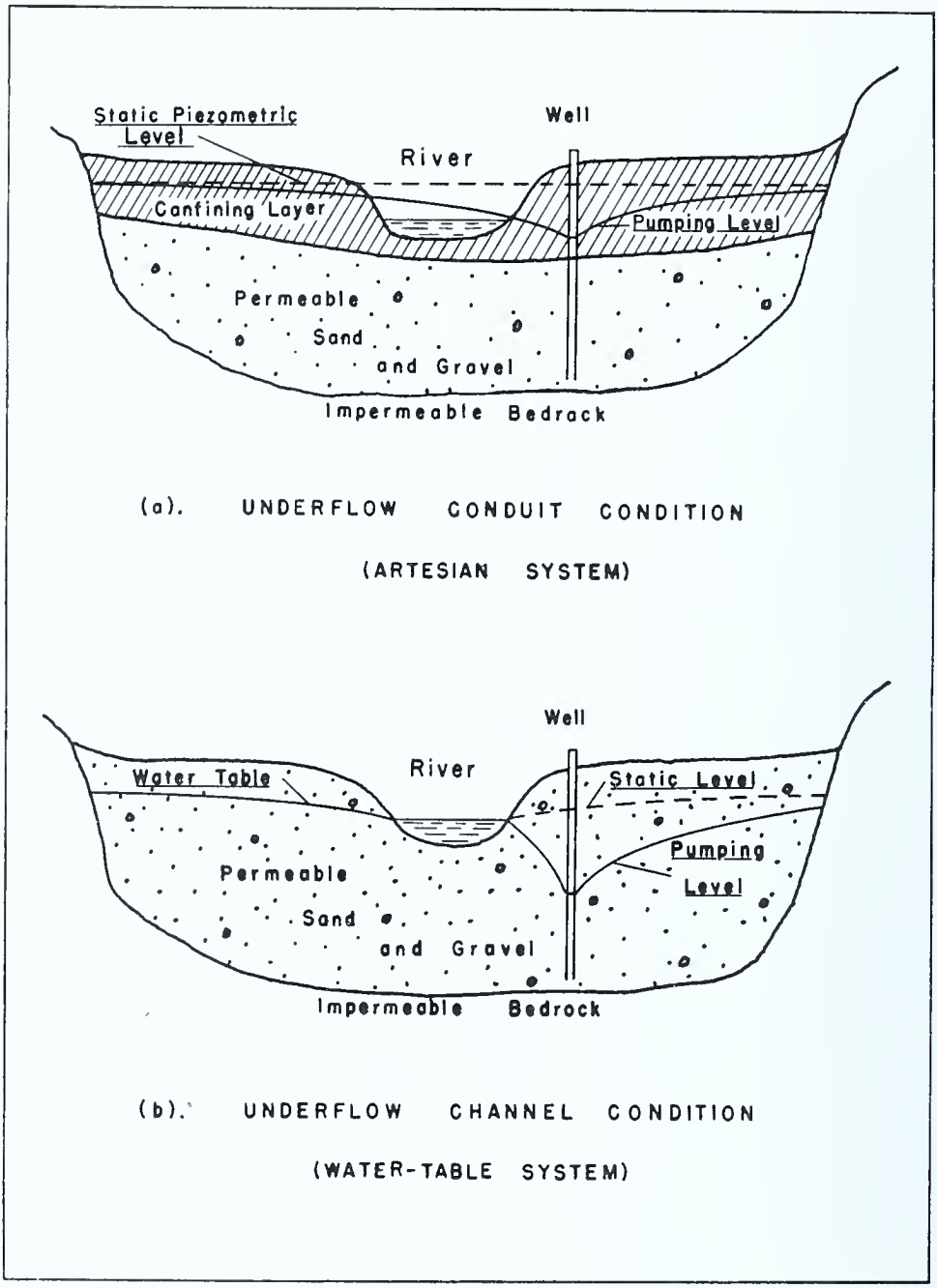

FIGURE 3. Diagrams showing typical occurrence of ground water in valley-fill deposits and effects of pumping from wells.

draulic gradient of 1 foot of head per foot of distance at a temperature of 60° F. The *coefficient of storage* for water-table conditions may be considered to be the same as the *specific yield,* which is the volume of water that will drain by gravity from 1 cubic foot of saturated material. For artesian conditions the aquifer is not unwatered when the pressure drops, and the coefficient of storage is represented by the comparatively

small amount of water released by the compaction of the beds and the expansion of the water as the pressure is decreased.

These general statements and definitions are explained in more detail in the writings of Meinzer (1923 and 1942).

FLUCTUATIONS OF WATER LEVEL

Ground-water levels seldom remain stationary, but rise and fall generally in response to recharge to and discharge from the aquifer. Daily, weekly, and annual cycles of fluctuation have been observed by means of periodic measurement of water levels in observation wells. The factors causing such fluctuations are both natural and man-made. The man-made effect of withdrawal through wells is superimposed upon the effects of precipitation, evaporation, transpiration, and natural flow.

Under natural conditions, ground-water levels are influenced by variations in precipitation, evaporation, and transpiration. The water table in most places in western Pennsylvania generally is lowest in late summer and early fall, and highest in late winter and early spring. The greatest increases to ground-water storage from precipitation occur during the nongrowing season after soil moisture has been replenished in the zone of aeration above the water table.

Ground-water levels in rural areas in Beaver County fluctuate through a normal annual range in response to the average distribution of rainfall. The parts of aquifers adjacent to surface streams are often recharged to capacity by flood waters in a very few days, replacing storage that has been depleted over many months. Along the Ohio River ground-water levels rise rapidly each time the river rises much above normal pool stage, indicating recharge at accelerated rates. Recharge is probably being furnished at all times to the valley-fill aquifers wherever ground-water levels are drawn below river level.

General declines occur when natural recharge is decreased or when the rate of withdrawal by pumping exceeds the rate of recharge. The water level in a pumping well will continue to drop until the effect of the pumping has reached areas of natural recharge, or has salvaged or intercepted ground-water discharge in an amount equal to the rate of pumping. Stabilization of the pumping water level is accomplished by inducing recharge water into the formation from direct precipitation or from a surface source such as a lake or river in amounts equal to the pumpage. Equilibrium also is accomplished by cutting off the natural discharge at springs, seeps, and in places where evaporation and transpiration are dispersing water to the atmosphere. The lowering or drawdown of the water level in a well generally will be less when recharge is near to than when it is far from the well. The gradients necessary to transmit water readily from a source of recharge to a point of withdrawal are steeper in less permeable aquifers than in more permeable aquifers.

Ground-water levels are invariably lowered in and around a well when it is being pumped. The amount and extent of the lowering depends on the hydraulic properties of the aquifer, on the period and amount of pumping, and on the rate of recharge. Under water-table conditions this

drawdown is an actual lowering of the water surface and dewatering of the aquifer. Under fully artesian conditions it is a decrease in the piezometric pressure and a lowering of the pressure surface with no appreciable dewatering of the aquifer itself.

WATER-BEARING PROPERTIES OF ROCK FORMATIONS

Consolidated Rocks

In Beaver County the consolidated rock formations are not sources of large quantities of ground water. The largest recorded yield of a rock well is 50 gallons a minute. The chief use of such wells is for domestic and farm supplies in areas beyond the limits of existing public water mains. It is believed that the Mississippian sandstones and shales (Mauch Chunk and Pocono) are too deeply buried in Beaver County to be sources of fresh water; there are no records of water wells penetrating these or older formations. Table 2 lists the principal rock units in Beaver County and describes their water-bearing properties.

Adequate supplies of high to moderately mineralized water can generally be obtained for domestic and farm use from the Homewood and Connoquenessing sandstones of the Pottsville series. In many places in western Pennsylvania the aquifers of the Pottsville series contain water high in iron and, although suitable for domestic use, it is ordinarily unsatisfactory when used in boilers or for other industrial purposes.

Of the Allegheny group apparently only the Butler and Freeport sandstone are sources of ground water. They are variable lithologically as a result of facies changes. In some places they are rather thick, massive sandstone yielding moderate supplies of water; whereas in other areas they are almost entirely shale and consequently yield small supplies. Ground water in the sandstones of the Allegheny group is moderately mineralized and commonly is high in iron. On the basis of present information, the limestones and clays in the Allegheny group apparently are not productive or potentially productive as sources of ground water.

The Conemaugh group, which crops out over much of the higher areas of Beaver County, contains two sandstones (Mahoning and Morgantown) that yield moderate supplies of ground water under favorable conditions. The Mahoning sandstone, at the base of the Conemaugh group, and which overlies the Upper Freeport coal, is a coarse-grained sandstone that yields as much as 25 gallons a minute south and southwest of Beaver County. The Mahoning sandstone probably varies from place to place in its capacity to yield water to wells. The Morgantown sandstone, about 350 feet higher in the stratigraphic column, is penetrated by wells only in the southern part of the county. Where massive and below the water table, this sandstone yields relatively large supplies of ground water for domestic use.

Valley-Fill Deposits

The Wisconsin glacial-outwash deposits in the Ohio River valley are a source of abundant ground water for many industries and municipalities in Beaver County. The material is a mixture of sand and gravel which is

TABLE 2. *Generalized section and water-bearing properties of rocks in Beaver County.*

SYSTEM	SERIES	GROUP	THICKNESS (feet)	CHARACTER	WATER-BEARING PROPERTIES
Quaternary	Recent and Pleistocene		0-150	Fresh stony till covering uplands north of border of glaciation. Stratified clay, sand, and gravel outwash in the main stream valleys.	Wisconsin outwash in Ohio Valley yields very large supplies. Glacial drift in northwest yields some water to shallow wells. Pre-Wisconsin gravels beneath high terraces along rivers are not water bearing.
Pennsylvanian	Upper Pennsylvanian	Monongahela	35+	Sandstone and shale overlying the Pittsburgh coal; caps only a few hills in southern part of county.	Not a significant source of water owing to limited distribution.
		Conemaugh	520±	Shale, coarse sandstone, and local thin beds of limestone and coal. Upper part mostly sandy, lower mostly shale. Some prominent beds of green and red shale.	Moderate supplies from coarse phase of Mahoning sandstone and from thick Morgantown sandstone in southern part of county.
		Allegheny	280-345	Shale, sandstone, fire clay, coal, limestone. Sandstone predominates but in places becomes thin-bedded and shaly. Limestones, generally thin, locally develop considerable thickness. Fire clay generally present beneath coal seams.	Adequate supplies for domestic use in Butler and Freeport sandstones where they are massive and not shaly. Other members not generally productive in this area.
	Pottsville		200±	Coarse siliceous sandstone and fine conglomerate. In places massive and cross-bedded, containing interbedded shale.	Yields up to 50 gpm from Homewood sandstone and possibly from Connoquenessing sandstone. Water may be high in concentration of iron.

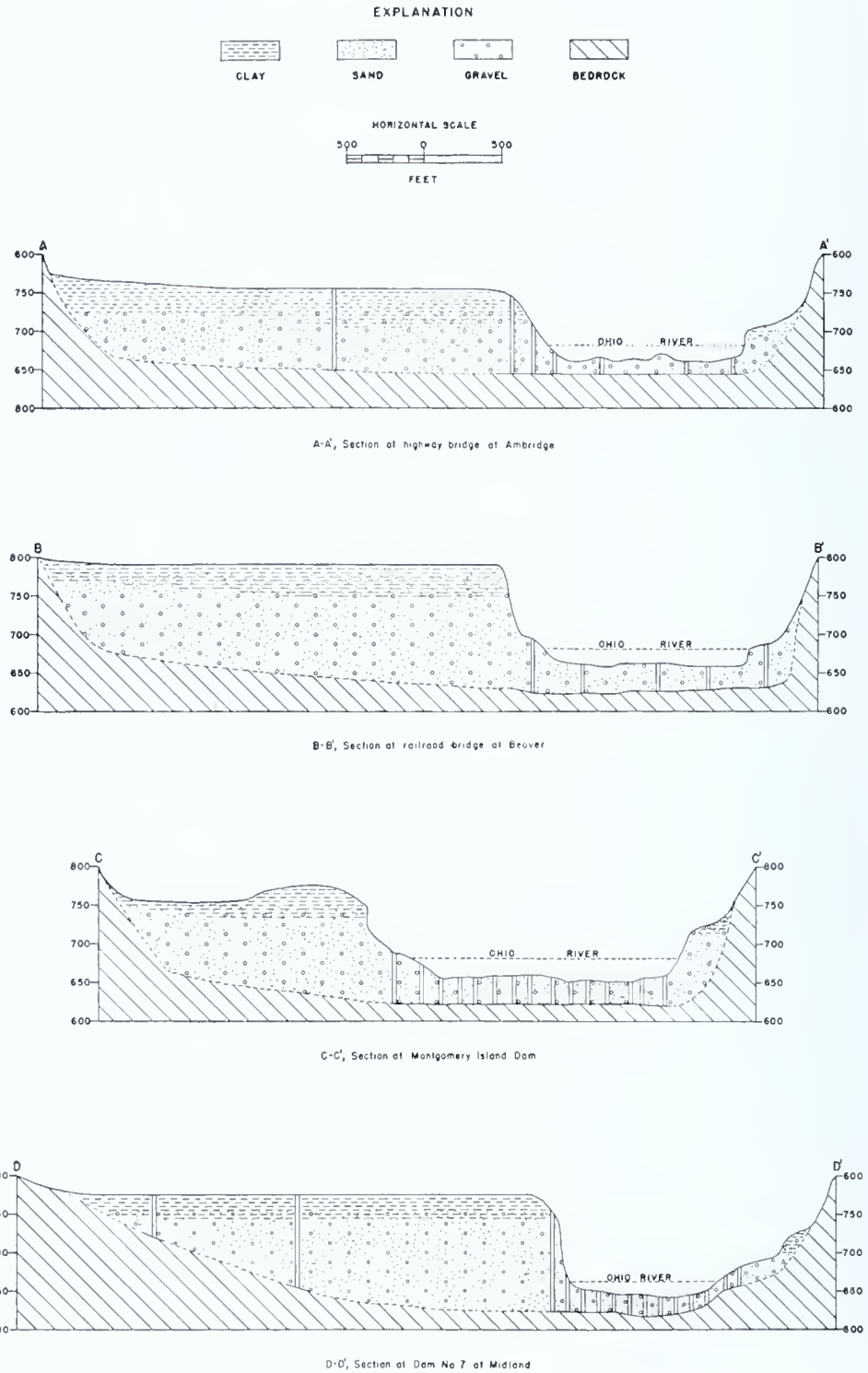

FIGURE 4. Geologic sections across Ohio River valley, looking upstream at Ambridge, Beaver, Montgomery Island Dam, and Midland.

coarse near the bottom and becomes finer and more sandy toward the top. A silt layer of Recent age commonly overlies the sand and gravel of glacial origin. Artificial fill has been built up by man to accommodate industrial plants at various places on the flood plain. A maximum thickness of sand and gravel of 130 feet is indicated by well logs, but it seems probable that the thickness approaches 150 feet in some localities. Clay which reduces the permeability of the deposits, is present in varying quantities. The gravel consists of water-rounded fragments of granite, gneiss, and diabase from regions to the north, and sandstone and limestone of local origin. Some of the cobbles are as much as 10 inches in diameter.

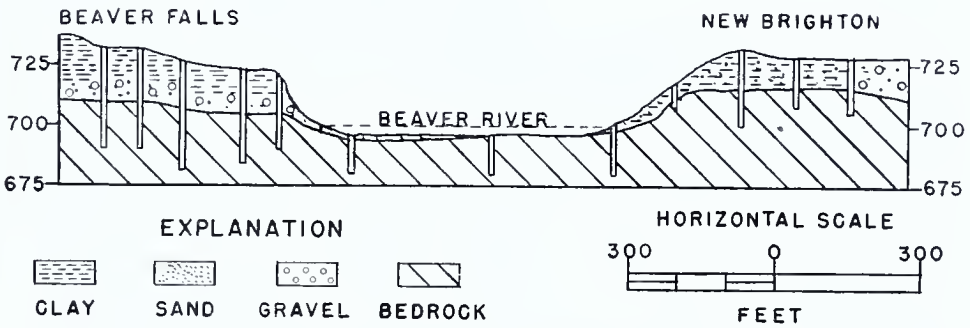

FIGURE 5. Geologic section across Beaver River valley at railroad bridge at Beaver Falls.

The present Ohio River meanders from side to side in the pre-Wisconsin valley so that the width of the flood plain and the depth to the rock floor vary with the location in the valley. Geologic cross sections have been drawn for five locations in Beaver County, four across the Ohio Valley and one across the Beaver Valley. These are shown in Figures 4 and 5, and the locations are given on the map (pl. 1). Sections *A-A'* to *D-D'* illustrate the wide shallow form of the Ohio River valley and its high terraces and gently sloping rock floor. Although not shown in the cross sections, the ground-water table generally lies at the same altitude of or just above the normal river level, sloping gently toward the river where unaffected by pumping. Thus, much of the valley-fill material above present river level is not saturated, but serves as a filter medium for precipitation on its route to the water table. Section *E-E'* across the Beaver River valley (fig. 5) shows that the present river flows on bedrock in places, and that little, if any, unconsolidated sand and gravel is present below river level. Therefore, the saturated thickness of the sand and gravel deposits in this area is thin and not favorable for the development of large groundwater supplies. The sediments which lie on the flanks of the present valley at this location are generally fine materials, poorly sorted, and generally of low permeability.

Remnants of pre-Wisconsin glacial deposits are found at higher altitudes along the Ohio and Beaver Valleys. These materials are deeply weathered and have a sandy or clayey matrix. They lie above drainage level and do not constitute a source of ground water. The Carmichaels formation, found principally in the valley of Raccoon Creek but not shown on Plate

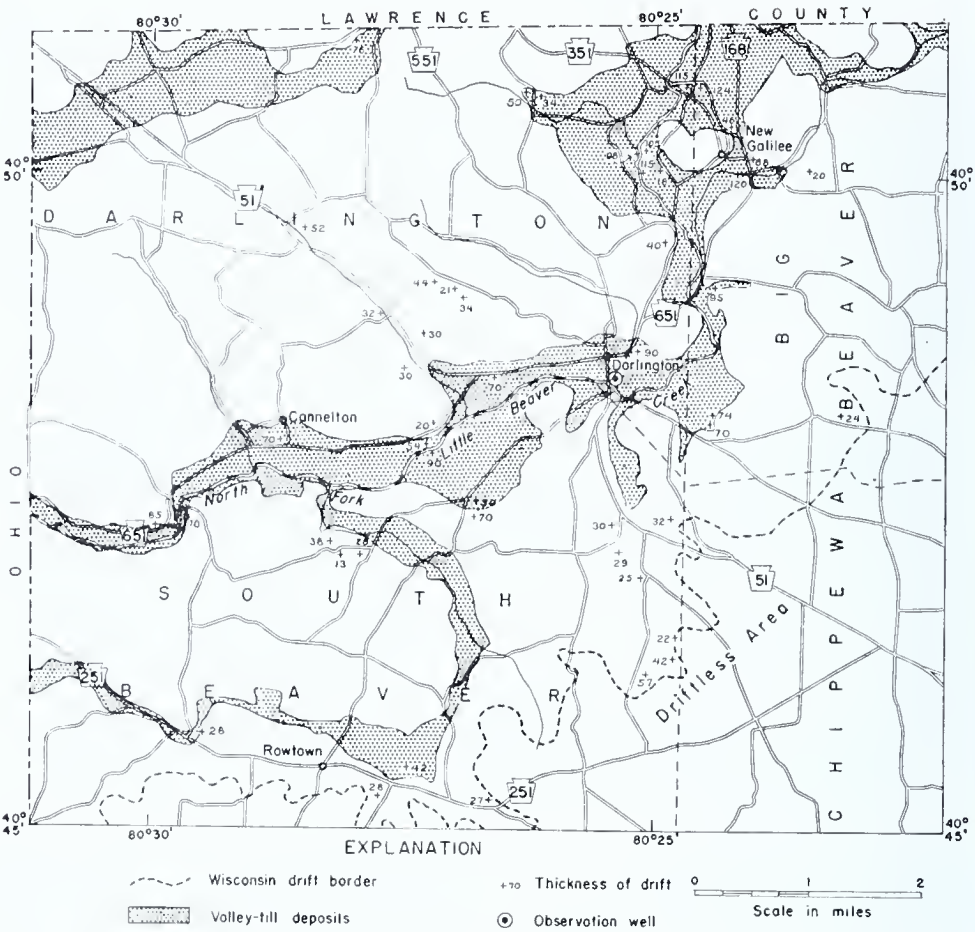

FIGURE 6. Map of Little Beaver Creek valley area near Darlington showing extent and thickness of glacial deposits, and location of observation well.

1, is made up of material wholly local in origin and is neither thick enough nor permeable enough to be an important water-bearing formation.

The gravels in the valleys inside the glacial boundary in the northwest corner of Beaver County differ from those that occur along the Ohio mainly in the manner of deposition. The alluvium and outwash in the valley of the North Fork of Little Beaver Creek and some of its tributaries came directly from the ice front during the Wisconsin stage in melt water drained from the north and northeast in this area. These materials partly filled a deep valley incised in the bedrock. The present stream now occupies the aggraded floor of this buried valley. As shown in Figure 6, the deposits are as thick as 124 feet in places, and are mostly below present stream level. The thicknesses indicated on the map were reported in domestic wells, bore holes, and in old oil and gas wells. Where predominantly coarse and not sealed off from surface recharge or from the stream by clay layers, these deposits should be capable of furnishing large supplies of ground water to wells. The upland areas of the Little Beaver Creek valley are covered by thin pre-Wisconsin drift, and bedrock is exposed in many hillsides north of the glacial boundary. In some places, small domestic water supplies can be obtained from shallow wells

dug or drilled into the mantling deposits. Generally, however, ground water can be obtained in the uplands from underlying rock formations even in the glaciated areas.

The nature and magnitude of fluctuations of the water level in the buried-valley gravels are shown for the period April 1949 to April 1950 on the graph in Figure 7. The fluctuations were recorded by means of an automatic gage installed on an abandoned well at Darlington. The water level rose the most in winter and early spring after heavy rainfall, as shown by the record of rainfall at Beaver Falls, also plotted on this illustration.

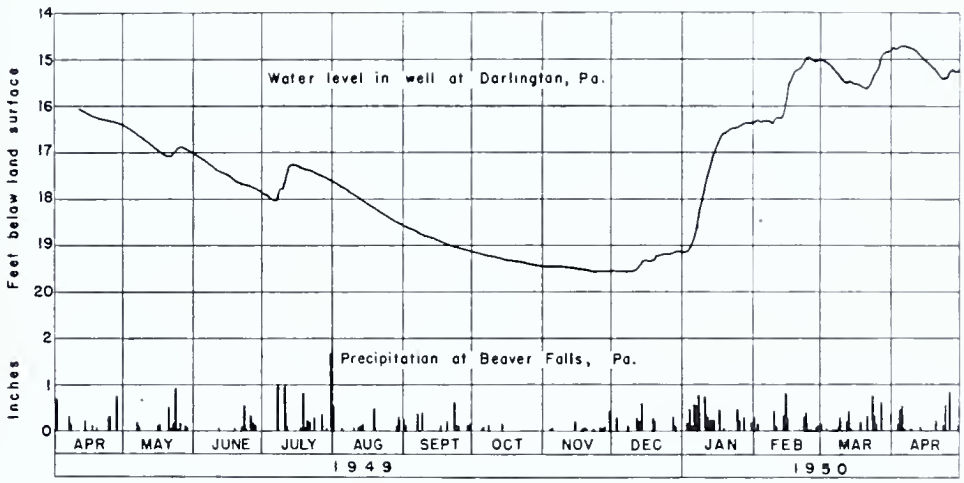

FIGURE 7. Water level in observation well at Darlington and precipitation at Beaver Falls.

DEVELOPMENT AND USE

During 1947 and 1948, a complete survey was made in Beaver County of municipal and industrial use of ground water. The details of well data and pumpage are included in this report in the Appendix under "Records of wells."

The valley-fill deposits in the Ohio River valley have been developed for ground-water supplies at many locations in Beaver County. Wells numbered 1 to 28, listed in Table 10 and shown on Plate 1, are all gravel wells drilled for industrial or municipal use. Some indications of the water-yielding properties of these gravels and the capacities of wells have been obtained from pumping tests that the drilling companies made after completing or cleaning the wells.

The *specific capacity* of a well is a term that is useful in comparing performances of wells. It is defined as the quantity of water pumped for each unit of drawdown, generally expressed in gallons a minute per foot. For most wells, the specific capacity will decrease as drawdown increases. If drawdown in a well increases with time, specific capacity will decrease with time. Comparisons of wells should be made, therefore, for equal periods of time or for conditions of stabilized drawdowns in all wells. The range in specific capacities for wells of the same diameter (table 3), can be attributed in part to constructional differences such as screen lengths,

TABLE 3. *Yield and specific capacity of wells in Ohio River gravels, Beaver County.*

WELL NO.	DISTANCE FROM RIVER *(feet)*	DIAMETER *(inches)*	TESTED PUMPING RATE *(gpm)*	DRAWDOWN *(feet)*	SPECIFIC CAPACITY
		OHIO RIVER ABOVE BEAVER RIVER, EAST SIDE			
1a	350	18	1,500	15	100.0
1b	350	18	900	23	39.1
1c	350	18	1,200	12.5	96.0
1d	375	8	100	9	11.1
3a	17	12	518	18	28.8
3b	35	12	465	22	21.1
3c	25	12	440	16	27.5
3d	22	12	500	17.5	28.6
3e	25	12	500	15.5	32.3
3f	40	12	500	15.5	32.3
3g	40	12	585	17	34.4
3h	40	12	565	19	29.7
4e	540	12	350	20.5	17.1
4f	400	12	268	28	9.6
4g	250	8	255	16	15.9
6	200	10	304	12	25.3
		Average	559		34.3
		OHIO RIVER ABOVE BEAVER RIVER, WEST SIDE			
18c	50	10	105	18	5.8
18d	50	10	250	8.4	29.8
18e	50	10	225	6.5	34.6
18f	50	10	175	4	43.8
18g	50	10	200	14	14.3
18h	50	10	150	8	18.8
18i	50	10	135	9.4	14.4
18j	50	10	142	7.8	18.3
19	1,800	12	200	26	7.7
20	750	8	125	7	17.9
21	1,000	16	575	7.5	76.7
25a	180	16	820	15	54.7
25b	780	16	860	24	35.8
26a	50	16	575	14	41.1
26b	50	16	615	14	43.9
26c	50	16	590	13	45.4
26d	50	16	575	20.5	28.0
26e	50	12	600	15	40.0
26f	50	16	745	12.5	59.6
		Average	403		33.2
		OHIO RIVER BELOW BEAVER RIVER			
8c	250	12	910	16.5	55.2
8d	250	12	960	17.5	54.9
8e	250	12	960	19	50.5
10a	450	12	610	16	38.1
10b	450	12	720	5	144.0
10c	450	12	640	12	53.3
12	125	10	195	5	39.0
15b	160	16	835	4	208.8
15c	150	16	800	2.5	320.0
15e	1,400	12	410	27	15.2
17c	200	12	1,380	22	62.7
		Average	765		94.7
		AVERAGE, all 46 wells	544		48.3

size of screen openings, and kind and extent of development, and to variations in the permeability of the water-bearing deposits. In addition, many of the values of specific capacity are based on estimates rather than accurate measurements of both the discharge of the well and the total drawdown.

The average tested yield of 46 wells in the glacial gravels of the Ohio Valley is 544 gallons a minute, and the average specific capacity is 48.3 gallons per foot of drawdown. The greatest tested yield is from an 18-inch well of the American Bridge Co., which produced 1,500 gallons a minute with a drawdown of 15 feet. The specific capacity, 100, of this well is the greatest recorded upstream from the mouth of the Beaver River. Below the Beaver River two wells at the Koppers Co. chemical plant tested at specific capacities of 320 and 209. These wells are 16 inches in diameter, located about 150 feet from the river at a place where the gravels are at least 130 feet thick. Monaca Borough operates five 10-inch wells having specific capacities less than 20, the lowest being 5.8. These wells are located opposite the mouth of the Beaver River where the depth to the bedrock floor is less than 50 feet.

PUBLIC SUPPLIES

Ten water companies have drilled wells in the glacial outwash gravels of the Ohio Valley and developed a combined pumpage in 1948 averaging 7.6 million gallons a day. The Borough of Koppel obtains its supply from wells developed in the Homewood sandstone. Ambridge Borough and the Woodlawn Water Co. at Aliquippa, the largest ground-water users, are discussed in detail, as is the Borough Township Municipal Authority. Table 4 lists information on the municipal water supplies in Beaver County, including two derived from surface sources. Locations of the public-supply wells are shown on Plate 1.

TABLE 4. *Municipal water supplies in Beaver County in 1948.*

MUNICIPALITY OR WATER COMPANY	AVERAGE PUMPAGE *(mgd)*	PER CENT TO INDUSTRIES	POPULATION SERVED	SOURCE
	GROUND WATER			*Number of Wells*
Ambridge Borough	2.87	60	17,600	8
Woodlawn Water Co.	2.60	40	24,000	7
Beaver Borough	.72	0	7,500	20
Monaca Borough	.58	31	7,200	10
Borough Twp. Authority	.28	41	2,200	3
W. Aliquippa Borough	.26	50	2,500	2
Baden Borough	.10	0	2,100	10
Conway Borough	.10	50	1,500	1
S. Heights Water Co.	.08	0	2,300	2
Koppel Borough	.02	0	1,000	2
Monongahela Land Co.	.01	0	400	2
Total	7.62	Average 42	Total 68,300	Total 67
	SURFACE WATER			*River*
Beaver Falls Authority	5.85	52.5	48,000	Beaver
Midland Water Co.	1.19	55	5,200	Ohio
Total	7.04	Average 53	Total 53,200	

Ambridge Borough

The Ambridge waterworks department, under the supervision of J. Z. Columbia, operates eight drilled wells and a modern treatment plant to supply nearly 3 million gallons a day. The department originated in 1913 by absorbing the Harmony Water Co., which had wells in the part of Ambridge then known as Economy. A softening plant was placed in service on April 1, 1934. Between 1913 and July 1946 many wells were drilled (in what is now the old well field) along the Ohio River in the vicinity of the plant (table 5).

TABLE 5. *Number of municipal wells in use at Ambridge, 1914-37.*

DATE	ADDED		ABANDONED		IN SERVICE		TOTAL
	UPSTREAM	DOWNSTREAM	UPSTREAM	DOWNSTREAM	UPSTREAM	DOWNSTREAM	
Jan. 1, 1914.....						6	6
Aug. 29, 1914.....	10	4			10	10	20
Oct. 5, 1922.....	10			6	20	4	24
Feb. 7, 1924.....		15			20	19	39
Feb. 11, 1926.....				4	20	15	35
May 15, 1937			6		14	15	29

These wells were all about 36 feet deep and were pumped as a unit by suction. The locations of both old and new well fields are shown on Figure 8. Pumpage from the old well field, upstream and downstream lines combined, averaged 0.62 million gallons a day from 1915 to 1920 and 1.21 million gallons a day from 1921 to 1936. The monthly volumes pumped from 1942 to 1949 are shown by the graph in Figure 10. The average daily pumpage, 1942 to 1949, was 2.46 million gallons a day or more than twice that of 20 years ago.

The old wells were abandoned in July 1946 when the eight new wells (no. 3 on pl. 1) were placed in service. Increasing difficulty with chemical quality and with decreasing yields in the old wells forced their abandonment. It is known that industrial wastes discharging into the small creek near these wells aided in their contamination. This is indicated in part by the manganese content in a sample taken in August 1943 which was 133 parts per million. The zeolite sand in the filter beds was ruined, and many complaints from consumers were received at this time. The acidic condition of the creek water in October 1942 is indicated by the reported hydrogen-ion concentration (pH) of 4.5. Table 6 shows the general increase in concentration of manganese in the well water from the old field during the wartime production period.

For purposes of comparison with the data in Table 6 some characteristics of water in the new wells are shown in Figure 11 together with data on the Ohio River at Ambridge for the period October 1945 to December 1949. The relation of well water to river water is discussed more completely in the "Quality of water" section.

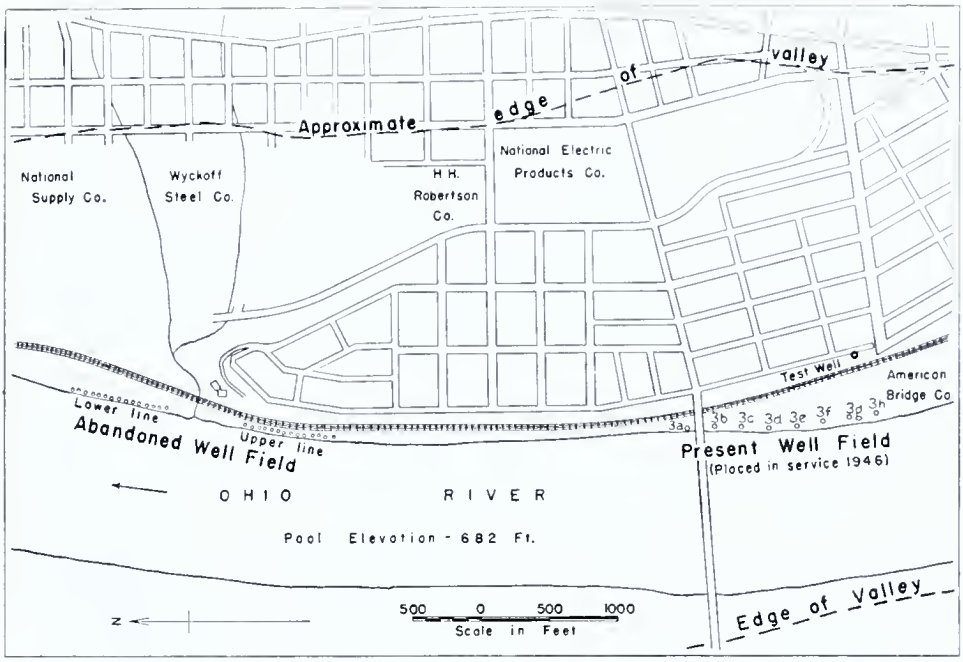

FIGURE 8. Map of part of Ambridge showing locations of old and new well fields.

Not only was the quality of water, as measured by the concentration of iron and manganese much better in the new wells, but the yields also were longer. The eight new wells produced 2.87 million gallons a day in 1948 as compared to 1.41 million from 35 wells in 1936. Details on the new Ambridge wells are given in the "Records of wells" in the Appendix of this report.

A controlled pumping test was run on well 3b (table 10) on November 10, 1949, to determine the hydrologic properties of the aquifer and the interference between wells in the group (fig. 8). Well 3b was pumped at the rate of 300 gallons a minute and wells 3a and 3c were used as observation wells to measure the drawdown of water level caused by pumping well 3b. The results from the two observation wells are shown by the time-drawdown curves in Figure 9. The values of the coefficients of permeability and storage were computed, using the Theis nonequilibrium

TABLE 6. *Concentrations of manganese, iron, and hardness in water from wells at Ambridge, 1931-43.*

DATE	WELL OR WELLS	MANGANESE (*ppm*)	IRON (*ppm*)	HARDNESS (*ppm*)
Feb. 2, 1931	Upper line	3.6		
Feb. 2, 1931	Lower line	4.2		
Oct. 12, 1942	Upper line	9.9	3.4	
Oct. 12, 1942	Lower line	10.8	3.4	
Aug. 23, 1943	Upper—5-well average	39.1	1.62	373
Nov. 1, 1943	Lower—1 well	18.6	1.4	357
Nov. 12, 1943	Upper—4-well average	1.55	.04	182
Nov. 15, 1943	Upper—1 well	11.8	1.18	272

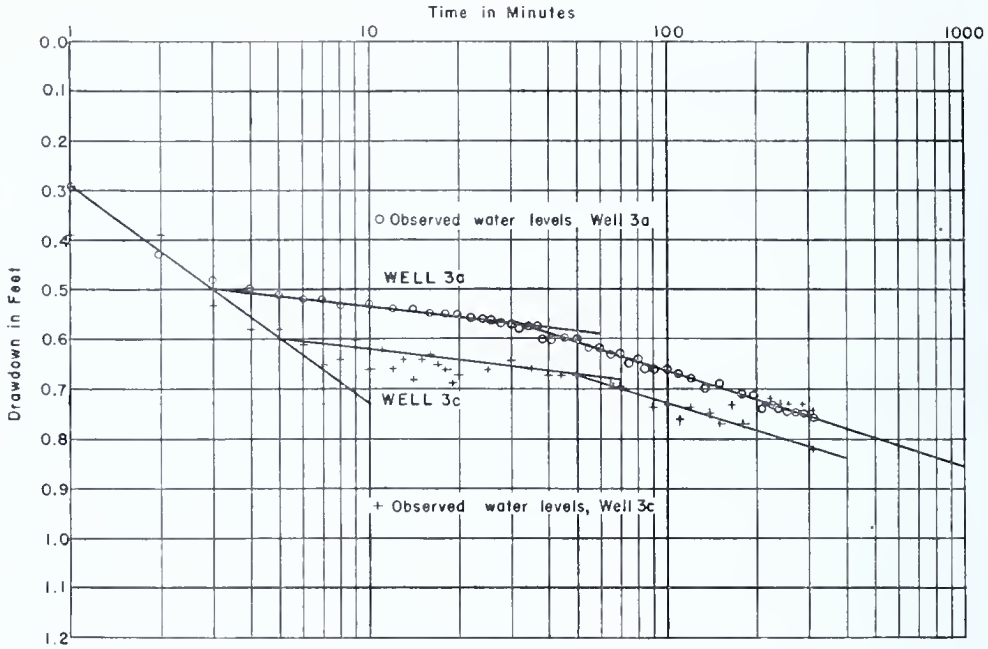

FIGURE 9. Graphs showing time-drawdown curves for pumping test at Ambridge on November 10, 1949.

formula. According to this formula (Wenzel, 1942) the time-drawdown relation at any point in an aquifer is a straight line on semi-log plotting paper when sufficient time has elapsed for any uniform aquifer of unlimited areal extent being pumped at a uniform rate. Variations from a straight-line relation indicate conditions of recharge or areal limits of the aquifer. Probable errors in observational data during the first few minutes of the pumping preclude analysis of the first straight-line part (limb) of the curves in Figure 9. The change in slope (second limb), that of well 3a beginning after about 3 minutes and that of well 3b beginning after about 5 minutes, indicates that recharge is being derived from the adjacent Ohio River. The third limb of the curves, at a steeper slope than the second, indicates that the effect of pumping reached a boundary of the aquifer.

From the test data and from available geologic information, which are merely indicative of the hydraulic properties rather than being precise, it is estimated that: 1. The effective line of recharge is approximately 100 to 200 feet west of the line of wells; 2. The indicated boundary of the aquifer is probably 1,000 to 2,000 feet east of the line of wells; 3. The coefficient of permeability is in the order of 1,500 gallons a day per square foot; 4. The coefficient of storage is in the order of 0.0002, a true artesian value; 5. The interference effects between wells in the group are relatively small—after 1 day of pumping well 3b at the rate of 300 gallons a minute the drawdown in each adjacent well (200 feet away) was less than 1 foot.

These data and results of further testing in the Ambridge field may help to determine whether additional development of the area is possible and in what direction new well sites should be sought. It appears that

the logical direction is upstream (south) along the Ohio River toward the American Bridge Co. At present the most southerly Ambridge well is about 4,000 feet from the nearest American Bridge well and probably neither well interferes with the other.

Woodlawn Water Co.

This public water-supply company is owned and operated by the Jones and Laughlin Steel Corp. It serves the steel plant at Aliquippa and residents of Aliquippa and part of Hopewell Township. The growth of the water service is indicated by the list of wells drilled by the company (table 7).

TABLE 7. *Wells drilled for Woodlawn Water Co., 1907-48.*

YEAR	NUMBER OF WELLS	DIAMETER *(inches)*
1907	3	6
1909	3	6
1913	3	6
1923	10	10
1928	1	
1939-48	6	16
1939-48	1	12

The present well field consists of the last seven wells (no. 26 on pl. 1), listed in table 3. These wells are in Aliquippa on the west side of the Ohio River about 2 miles downstream (north) from the Ambridge wells.

The Jones and Laughlin steel plant now operates the 10-inch wells, which are no longer operated by the water company. In addition, this plant takes about 30 per cent of the water pumped by the Woodlawn Water Co. The monthly pumpage by the Woodlawn Water Co. since 1943 is shown on the graph in Figure 10, which also shows the average monthly hardness of the well water. It appears that with increased pumping the average hardness generally has decreased in the past 7 years, although subject to more or less seasonal variations.

Borough Township

The Borough Township Municipal Authority (Vanport) began in March 1942 to supply water to the Curtis Wright plant and associated residential areas during the war period. The well field (no. 10 on pl. 1) is on the north side of the Ohio River at Vanport, and it has an estimated capacity of 61 million gallons a month. The total monthly pumpage by the Authority is shown by the graph in Figure 10. The marked changes in the rate of pumping, indicated on the graph, are related to the following events: Tamaqui Village, 125 units, opened April 13, 1942; Van Clyff Homes, 24 units, opened July 1, 1942; Van Buren Homes, 400 units, opened August 17, 1943; V-J Day, August 15, 1945; and Curtis Wright plant was acquired by Westinghouse Electric Corp., March 15, 1947. Westinghouse used about 60 per cent of the total water pumped by the township in 1949.

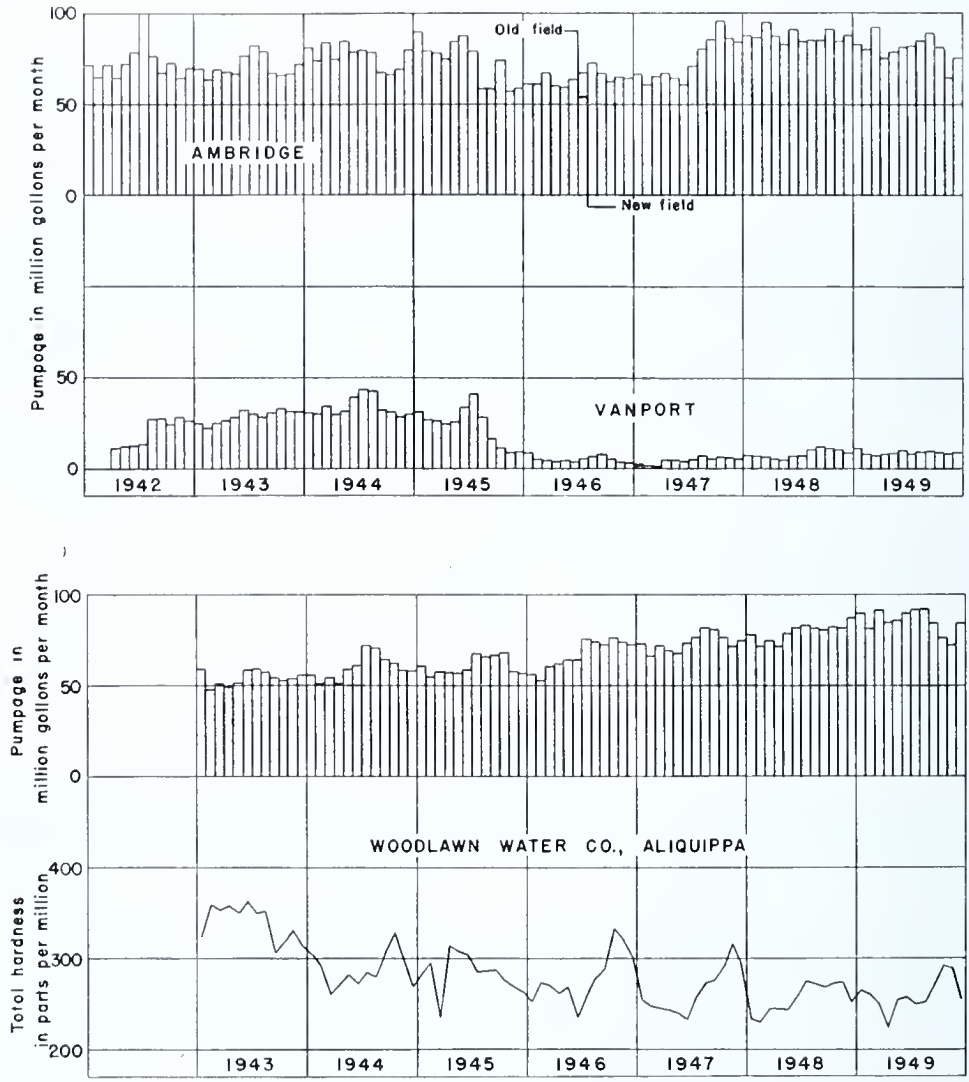

FIGURE 10. Monthly pumpage at Ambridge and Vanport, and monthly pumpage and average total hardness at Woodlawn Water Co., Aliquippa.

Other Public Supplies

The Beaver Borough supply is obtained from 6-inch wells (no. 8 on pl. 1), 10 of which are pumped regularly with one large pump. Three new 12-inch wells, drilled in 1947, have not yet been put into service. Monaca Borough uses ten 10-inch wells (no. 18) spaced about 60 feet apart along the Ohio River opposite the mouth of the Beaver River. West Aliquippa Borough pumps two 16-inch wells (no. 25) alternately. Baden Borough wells (no. 5) are on Crow Island in the Ohio River. About half of the water pumped by Conway Borough (no. 6) is used by the Pennsylvania Railroad at its Conway yards. The South Heights Water Co. (no. 28) serves South Heights Borough and the rapidly-growing sections of Hopewell Township. The Monongahela Land Co. (no. 11) supplies water to a real estate development at Ohioview in Industry Township.

INDUSTRIAL SUPPLIES

In Beaver County, 27 industries and commercial establishments use about 15 million gallons of ground water a day. Unlike Allegheny County, Beaver County has few air-conditioning units that use ground water, so the summer demand is not much greater than the winter demand. Nearly all the ground water is pumped from wells in the unconsolidated sediments of the Ohio River valley. The average yield of 70 industrial wells in the Ohio Valley in Beaver County is 212 gallons a minute. Only about 40,000 gallons a day is from wells in Beaver River valley, and less than 200,000 gallons a day is from bedrock aquifers.

The industry which uses the largest amount of ground water is the St. Joseph Lead Co. (no. 17 on pl. 1) which pumps an estimated 5.76 million gallons a day. The next largest amount, 4.46 million gallons a day, is used at the Freedom-Valvoline oil refinery at Freedom (no. 7). These two plants account for about two-thirds of the industrial ground-water pumpage. Other industries that pump more than 500,000 gallons a day include the following: Spang-Chalfant Division of National Supply Co. at Ambridge, 790,000 gallons a day; Koppers Co. Kobuta plant, 720,000 gallons a day; Pittsburgh Tube Co. at Monaca, 720,000 gallons a day; American Bridge Co. at Ambridge, 700,000 gallons a day; and National Electric Products at Ambridge, 630,000 gallons a day. Four other industrial plants each use between 100,000 and 500,000 gallons a day. The use by types of industries is shown in Table 8.

TABLE 8. *Industrial use of ground water in Beaver County.*

TYPE OF INDUSTRY	NUMBER OF PLANTS	NUMBER OF WELLS	DAILY PUMPAGE *(gallons)*
SAND AND GRAVEL AQUIFERS			
Metals and metal products	11	56	9,265,000
Chemicals and chemical products	2	9	5,184,000
Clay, glass, and stone products	2	2	246,000
Food products	2	3	118,000
Mine and quarry products	1	1	72,000
Public buildings	1	2	30,000
Railroads	1	1	27,000
Total	20	74	14,942,000
BEDROCK AQUIFERS			
Metals and metal products	3	3	11,200
Public buildings	4	5	79,400
Clay products	3	7	53,000
Food products	2	4	35,400
Total	12	19	179,000

QUALITY OF WATER

Chemical and Physical Properties

All natural waters contain dissolved mineral matter from the rocks and soils with which they have come in contact. The quantity of dissolved mineral matter present depends primarily on the type of rock or

soils through which the water has passed, the length of time of contact, and the pressure and temperature conditions involved. In addition to these natural factors are others connected with human activities, such as use of streams and wells for disposal of sewage and industrial waste, diversion and use of water for many purposes, and drainage from coal mines and oil fields.

The base flow of streams consists largely of ground-water inflow, and the quality of water in unpolluted streams tends to approach the quality of the ground-water sources during periods of low flow. Although many of the factors that influence the quality of surface waters also influence the quality of ground water, fluctuations in chemical quality of ground water do not ordinarily occur in the same magnitude as in surface water. Because of the longer and closer contact with the geologic formations, underground water generally carries in solution greater amounts of soluble materials than are carried by surface runoff. Following is general information about the source and significance of the constituents of water, summarized by Pennsylvania Department of Commerce (1947).

Hydrogen-ion concentration (pH). The symbol pH represents the negative logarithm of the number of moles of ionized hydrogen per liter of water. It is an indication of the relative acidity or alkalinity of the water. A water with a pH of 7.0 is said to be neutral. Some alkaline waters have a pH higher than 8.0 and some waters containing free mineral acids have values less than 4.5. The pH of a water is used as a guide for determining the amount and type of treatment necessary to improve the quality of the water for industrial and domestic use.

Silica (SiO_2). This constituent is dissolved from almost all rocks and is present ordinarily in amounts of 3 to 30 parts per million. When present in relatively high concentrations, it contributes to the formation of boiler scale and is costly to remove from water.

Manganese (Mn). Traces of manganese are present in most rocks. Manganese oxides commonly are associated with iron oxides, especially in the coal-mining regions of this area. Manganese is particularly objectionable in water used in laundry work and textile processing, because of the dark brown or black stain caused by excessive amounts.

Iron (Fe). Water that occurs in beds of sulfur-bearing coal or in the accompanying pyritiferous shales has a relatively high content of dissolved iron. When the total amount of iron and manganese exceeds about 0.3 parts per million, the water may produce stains on fixtures and clothing. Deposition of iron salts or the growth of iron bacteria (crenothrix and others) may result in clogging of equipment used in industrial processes. Abandonment of wells owing to high iron content of the water is rather common in western Pennsylvania.

Calcium (Ca). Calcium is dissolved from nearly all rocks, especially limestone, dolomite, and gypsum. The concentration of calcium in natural waters varies widely. Some water may contain a few parts per million of calcium, whereas others may have several hundred parts per million of calcium. Calcium and magnesium cause hardness in water, which is the principal cause of boiler scale when the water is heated or evaporated.

Magnesium (Mg). Magnesium is dissolved from many rocks, particularly dolomites. Like calcium, it causes hardness in water, and water that contains much magnesium, particularly as magnesium chloride, is likely to be corrosive.

Bicarbonate (HCO_3). The presence of bicarbonate in water is due principally to the action of carbon dioxide on compounds of calcium, magnesium, and other bases. Some sodium bicarbonate water may contain more than 1,000 parts per million of bicarbonate, making the water unsatisfactory for drinking and cooking. Bicarbonates of calcium and magnesium produce carbonate or "temporary" hardness, which forms a relatively soft scale on water pipes and equipment.

Sulfate (SO_4). Sulfate is dissolved from rocks and soils. Large quantities are dissolved from gypsum. Also, it is formed by the oxidation of sulfides of iron and, therefore, is usually present in significant quantities in water from coal-mining operations. Sulfate in water that contains much calcium and magnesium causes the formation of a hard scale in steam boilers and may increase the cost of softening water.

Chloride (Cl). Chloride is dissolved in small quantities from many rocks. The chlorides of calcium, magnesium, sodium, and iron are readily soluble. Chloride in drinking water has little effect on its fitness for use unless it is present in quantities that exceed 250 parts per million. Salty taste will be noticed by many people when the concentration exceeds 500 parts per million.

Nitrate (NO_3). Few rocks contain appreciable quantities of nitrate, and most natural waters contain only small concentrations. Nitrate in water may indicate previous contamination by sewage or other organic matter, as it is a final oxidation product of all nitrogenous organic matter.

Dissolved solids. The quantity reported as dissolved solids, that is, the residue on evaporation, consists mainly of the dissolved minerals in the water. Some organic matter and water of crystallization may be included. Water with less than 500 parts per million of dissolved solids is generally satisfactory for most uses. Water with more than 1,000 parts per million of dissolved solids may require costly treatment before it can be made suitable for most domestic and industrial uses.

Hardness. Hardness is predominantly caused by compounds of calcium and magnesium, although aluminum, iron, manganese, and free acid may contribute to hardness. It is expressed as the quantity of calcium carbonate that is chemically equivalent to all the hardness-causing constituents. Water with less than 50 parts per million hardness is usually considered soft and treatment is seldom justified. Hardness between 50 and 150 parts per million does not interfere seriously with the use of water for many purposes, but its removal by a softening process may be profitable for laundries and other industries. Water having hardness greater than 150 parts per million can profitably be softened for many uses, although water having hardness greater than 150 parts per million is widely used without treatment for domestic and cooling purposes and for irrigation. Well water is usually harder than river water in the same area, inasmuch as the rivers contain larger proportions of rain-water runoff which has passed quickly over the ground rather than slowly through it.

Alkalinity. Alkalinity of water is usually caused by bicarbonates of calcium and magnesium or by carbonates or hydroxides of sodium, potassium, calcium, and magnesium. It is expressed in parts per million of calcium carbonate and is determined by titration using an organic indicator, such as methyl orange (MO) to indicate the end point of the titration.

Acidity. Acidity in water is caused by mineral acids, free carbon dioxide, and hydrolysis and sulfates of iron and aluminum. Many industrial users express acidity in terms of parts per million of calcium carbonate chemically equivalent to the titrated acid. Acidity is determined by titration using an organic indicator, such as phenolphthalein (Phen).

Specific conductance. The specific conductance of a water is a measure of its ability to conduct a current of electricity. It varies with the temperature and with the concentration and degree of ionization of the different minerals in solution. It aids in revealing changes in concentrations of the total dissolved minerals in waters. Specific conductance values are expressed as micromhos at 25° C.

Chemical Character of the Ground Water

Chemical analyses of water are necessary to determine whether water is suitable for specific purposes, and if not suitable, to determine what type of treatment is needed to make it satisfactory and what the cost of such treatment will be. The temperature of ground water is also an important consideration in view of the increasing use of ground water for industrial cooling. The temperature of ground water in Beaver County and the seasonal variation in temperature in some well waters are discussed in detail in a following section.

Analyses of water from 26 wells in Beaver County are included in this report. The analyses were made by water companies and private industries. They are listed in the Appendix under "Records of Wells," together with additional incomplete analyses for many other wells.

The quality of water from wells in the valley-fill deposits in Beaver County has been compiled from 26 analyses and is represented by the data in Table 9. The average quality of Ohio River and Beaver River water as analyzed by the U. S. Geological Survey is shown for comparison.

The maximum and minimum values for each constituent serve as an indication of the range in concentrations likely to be encountered in waters in the valley areas. The analyses for the Beaver River and the Ohio River represent the average of 10-day composites of daily samples for the water year October 1, 1945 to September 30, 1946. The well water samples were collected in the period 1940-47, and represent different precipitation and river flow conditions. As the samples obtained from wells represent spot determinations it cannot be said that the average of those analyses is strictly representative. However, the individual analyses probably are indicative of the variations in ground water that may be found at different localities in the valley-fill deposits. Most of the wells are close enough to the streams so that some part of the water pumped from them is from river infiltration. Where this relation exists, the concentration of dissolved solids in the ground water is usually decreased by the

TABLE 9. *Summary of quality of water from wells and rivers in Beaver County (parts per million, except pH)*

CONSTITUENT	WELLS				RIVERS *Average October 1, 1945 to September 30, 1946*	
	MAXIMUM	AVERAGE	NUMBER OF DETERMINATIONS USED IN AVERAGE	MINIMUM	BEAVER AT NEW BRIGHTON	OHIO AT AMBRIDGE
pH	7.8	7.2	26	6.1	6.8	5.6
Silica (SiO_2)	14	10	8	6.0	4.9	5.7
Manganese (Mn)	1.6	.28	15	0.0	.02	.41
Iron (Fe)	5.0	.47	24	0.0	.10	.05
Calcium (Ca)	175	81	17	24	39	27
Magnesium (Mg)	78	22	20	7.0	8.5	7.4
Bicarbonate (HCO_3)	96	83	8	63	43	—
Sulfate (SO_4)	325	108	20	25	94	108
Chloride (Cl)	103	35	26	14	18	15
Nitrate (NO_3)	8.0	5.4	3	3.5	5.7	2.3
Dissolved solids	670	478	13	260	223	199
Total hardness (as $CaCO_3$)	528	260	13	93	132	102
Alkalinity (MO) (as $CaCO_3$)	253	178	18	98	—	—
Acidity (Phen)	20	8.4	7	0	—	—
Loss on ignition	150	102	12	40	—	—
Free carbon dioxide	80	29	11	6	—	—

less concentrated water from river infiltration. The influence of stream infiltration on quality decreases as the distance of the well from the river increases, and as the volume of pumpage decreases.

The water from nearly all wells in gravel in Beaver County has a pH between 7.0 and 7.8. Two wells (nos. 2b and 2c in table 10) at the National Electric Products Co. in Ambridge, however, yield water that may have a pH as low as 6.1. The manganese and iron concentrations of ground water in the gravel usually vary from 0.0 to 0.2 parts per million, but on May 16, 1947 water from six wells (nos. 7a to 7f in table 10) of the Freedom-Valvoline Oil Co. contained an average of 1.7 parts per million of iron. At this same time, however, the average contents of calcium and magnesium were only 35 parts per million and 8.2 parts per million, respectively, the lowest amounts found for these constituents in the analyses of ground water from the 26 wells. The sulfate content for all well waters generally ranged from 50 to 200 parts per million, and chloride from 15 to 60 parts per million. Concentrations of total dissolved solids ranged from about 300 to 600 parts per million, and total hardness from 200 to 400 parts per million.

The relationship of the quality of ground water to surface water is illustrated by the graphs in Figure 11. Continuous sampling from the Ohio River and from the Ambridge municipal wells indicates that the variations of hardness of ground water from the Ambridge well field, as shown on Figure 11, more or less correspond directly with specific conductance, chloride, and sulfate variations in the river water. The wide range of pH values of the river water is not noted in the well water, although the river is the principal source of recharge to the Ambridge

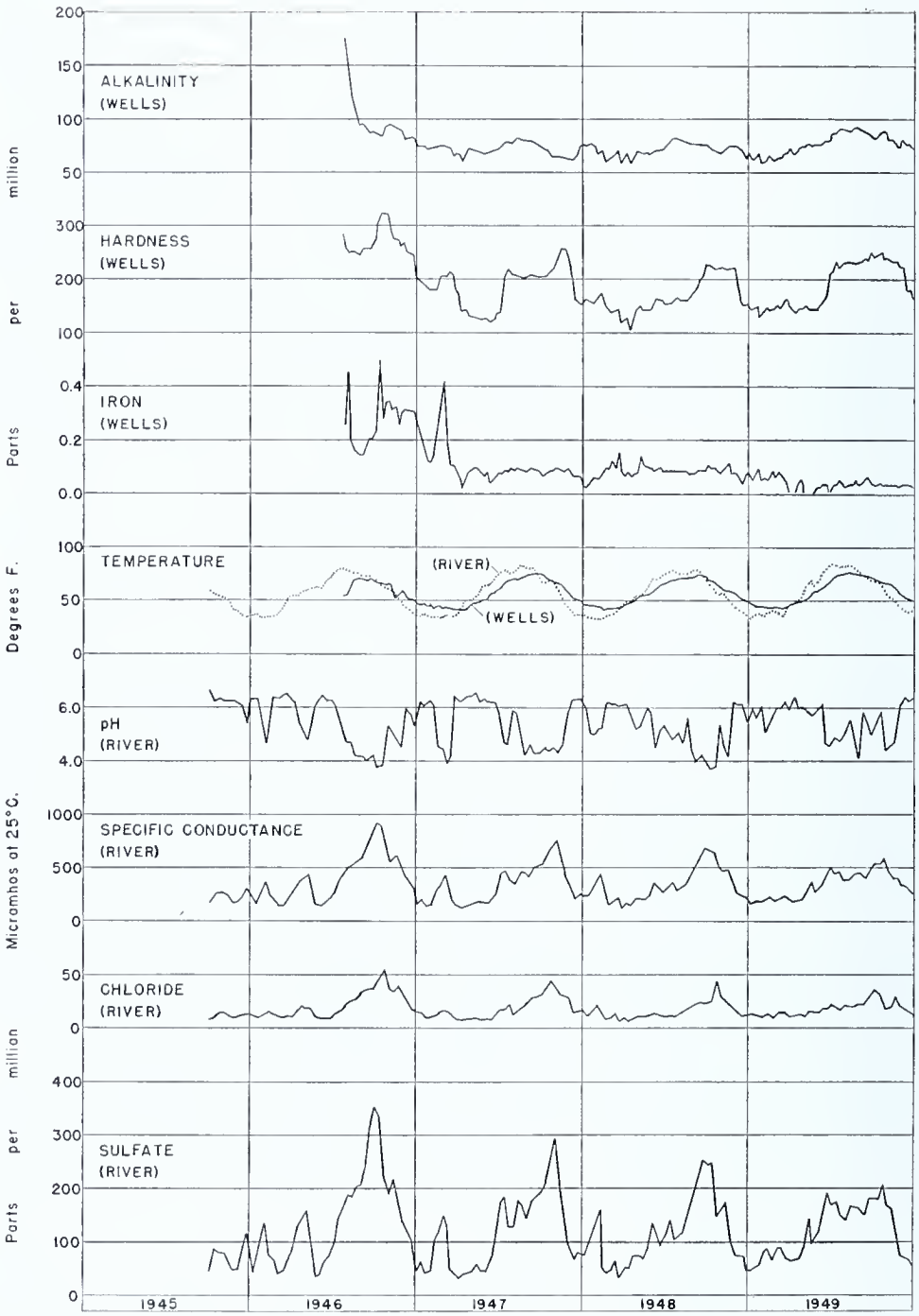

FIGURE 11. Some chemical characteristics of water in Ohio River and from present municipal wells at Ambridge.

wells. Whereas the pH of the Ohio River varied from 3.75 to 6.6, the pH of the ground water from Ambridge municipal wells was practically constant at 7.4.

At the time the Ambridge wells were first pumped, July 1946, the concentrations of alkalinity, hardness, and iron were considerably higher than at present (fig. 11). After only 1 month of pumping, the alkalinity (MO) decreased from 174 to less than 100 parts per million. About 8 months of pumping were required to lower the iron content below 0.2 parts per million. These changes, especially the drop in iron content, are believed to indicate a gradual change in the main source of the ground water from chiefly underground storage to more and more river infiltration. The graphs indicate that the quality of ground water when first tested in a new well may not be the ultimate quality after a period of continued use. The well water has no turbidity or bacterial contamination, although both are prominent in Ohio River water.

TEMPERATURE

With the great expansion in air conditioning and the continued importance of water in industrial cooling processes, the temperature of water supplies has become one of the most important physical characteristics to be considered. The temperature of surface waters often varies more than 50° F. from winter to summer, and industries that need constantly cool water either must depend on ground water or must artificially cool the surface water in summer. In general, the temperature of ground water varies only slightly, if at all, during the year, being about equal to the mean annual air temperature of the area. The temperature of ground water at most places in Beaver County is about 51° F., except where subject to artificial influences and to recharge from nearby streams. The effect of river infiltration on ground-water temperature is indicated by the temperature graph in Figure 11, which gives temperatures of well and river water at Ambridge. During the period of record the Ohio River had a temperature range of about 50° F. during the year, from 35° F. to 85° F., and the well water had a temperature range of about 35° F., from 40° F. to 75° F. In addition, the temperature pattern of the well water lagged behind that of the river water by approximately 1 month. This condition probably occurs at other locations along the Ohio and Beaver rivers, being most pronounced close to the streams. The complicated problem of temperature changes as related to heat transfer and storage and to viscosity are presented in more detail by Kazmann (1948) and Rorabaugh (1948).

CONCLUSIONS AND RECOMMENDATIONS

PRESENT USE

The geology of Beaver County is such that the most productive ground-water areas are located in the present stream valleys, especially that of the Ohio River. The unconsolidated sands and gravels of glacial origin furnish about 7.6 million gallons a day to public-supply systems and about 15 million gallons a day to industrial users. The total use of ground

water from bedrock formations is less than 200,000 gallons a day in the industrial areas, and probably less than that amount in the upland rural areas away from the major rivers.

Wells drilled into the valley-fill deposits of the Ohio River yield as much as 1,500 gallons a minute, and the average yield of 46 representative wells is more than 500 gallons a minute. Wells drilled into the bedrock aquifers yield only small to moderate quantities of water, generally sufficient for ordinary domestic use. The largest reported yield of a well developed in bedrock is 50 gallons a minute.

There is no evidence of abandonment of well supplies due to complete depletion of the supply or failure of recharge to maintain suitable water levels in well fields. Wells have been abandoned when continued use without cleaning or repair has resulted in excessive corrosion or clogging of screens and pumping equipment. Abandonment due to changes in the chemical quality also has been reported, as at Ambridge. In general, however, the quality of ground water in Beaver County is satisfactory for municipal use with moderate treatment and for many industrial uses with little or no treatment. Water supplies pumped from wells near the Ohio River have chemical compositions related to that of the river and undergo changes as a result of differences in the river flow. These changes involve certain dissolved minerals and salts, acidity, hardness, and temperature.

FUTURE USE

It is evident that the use of ground water in Beaver County has been increasing during the years, even since the end of World War II in 1945. This is generally true throughout the country, in both urban and rural areas, but especially in industrial sections. On the basis of present trends it is reasonable to assume that the demand will continue to increase in the future.

The possibilities of augmenting existing ground-water supplies in Beaver County are good, especially along the Ohio River valley. Wells favorably situated for recharge from the Ohio River will be assured of a perennial source of supply. Present municipal pumpage probably can be increased substantially by new wells in existing well fields. Industrial supply of ground water, now about 15 million gallons a day, can be increased several times by tapping the valley sediments in new locations suitable for inducing river infiltration. From a geologic viewpoint, many sites are available for placing wells to provide new supplies or expand existing ground-water supplies.

The glacial deposits in the buried valley underlying the North Fork of Little Beaver Creek are sources of potential ground water. The present use in the Darlington-New Galilee area is small compared to the amounts probably available to properly constructed wells tapping the permeable gravels believed to be present adjacent to this stream.

In prospective ground-water areas geologic and hydrologic investigations should be made to determine the most suitable locations and spacings of wells. The services of competent water-well drillers and technical consultants are often good insurance against inadequate yield or failure of wells. The valley-fill deposits in Beaver County are excellent water

bearers, but only the proper geologic and hydraulic conditions will permit the water to be withdrawn perennially in large quantities.

The controls being placed and proposed by State and Federal Governments on factors affecting the physical and chemical quality of the Ohio River probably will result indirectly in ground water of better quality in areas close to the river. Rigid control of local conditions of pollution and industrial waste contamination likewise will prevent ruination of existing water supplies or aquifers available for future development.

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APPENDIX

TABLE 10. *Summary of wells in Beaver County.*

MAP NUMBER	OWNER OR TENANT	YEAR COMPLETED	SURFACE ELEVATION (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)	AQUIFER[1]	THICKNESS OF AQUIFER (feet)	WATER LEVEL		YIELD		USE OF WATER[2]	DATA AVAILABLE[3]
								DEPTH TO WATER LEVEL (feet)	DATE OF MEASUREMENT	YIELD OF WELL (gpm)	DATE OF MEASUREMENT		
1a	American Bridge Co.	1939	711	64.0	36, 18	G	24	29.0	1939	1,500	1939	G, C	g, a, p
1b	do.	1939	711	65.0	36, 18	G	24	28.5	1939	900	1939	C, G	g
1c	do.	1939	711	60.0	36, 18	G	17	24.5	1939	1,200	1939	C, G	g
1d	do.	1942	711	66.0	8	G	31	31.0	1942	100	1942	D	g, p
2a	National Electric Products Co.	1916	757	147	10	C						C, I	a
2b	do.	1923	755	100	10	G		74	1943	275		I, C	a, p
2c	do.	1943	755	104.2	36, 12	G		74	1943	375		C	a, p
2d	do.	1948	755	106.5	20	G	20	72	1948	450	1948	C	g, p
3a	Ambridge Borough	1945	691.5	42.6	13	G	18	1.5	1945	518	1945	P	g, a, p
3b	do.	1945	695.5	50.67	13	G	23	12.1	1945	465	1945	P	g, a, p
3c	do.	1945	691.6	44.3	13	G	35	8.1	1945	440	1945	P	g, a, p
3d	do.	1945	691.5	45.5	13	G	45.5	8.5	1945	500	1945	P	g, a, p
3e	do.	1945	691.6	43.6	13	G	43.6	6.1	1945	500	1945	P	g, a, p
3f	do.	1945	696.2	52.16	13	G	44.2	13.9	1945	500	1945	P	g, p
3g	do.	1945	698.3	56.6	13	G	27	16.25	1945	585	1945	P	g, a, p
3h	do.	1945	701.2	58.0	13	G	40	19.0	1945	565	1945	P	g, a, p
4a	Spang-Chalfant Division of National Supply Co.	1916	748	210	10	A						D, I	
4b	do.	1916	748	210	10	A						D, I	
4c	do.	1916	748	94.0	5	G						D, I	
4d	do.	1917	748	107.0	5	G						D, I	
4e	do.	1942	758	108.0	24, 12	G	92	73.5	1942	350	1942	D, I	g, p
4f	do.	1943	758	109.0	24, 12	G	67	79.0	1944	268	1943	D, I	g, p
4g	do.	1944	718	73.5	12, 8	G	45	40.25	1944	255	1944	D, I	g, p
5	Baden Borough		678	40	8	G						P	
6	Conway Borough	1939	707	69.0	16, 10	G	46	24.0	1939	304	1939	P	g, p
7a	Freedom-Valvoline Oil Co.	1938	700	60.7	16	G		26	1938			C	a
7b	do.	1938	700	66.6	16	G		26.0	1938			C	a
7c	do.	1940	700	62.5	18	G		26	1940			C	a
7d	do.	1942	700	64.0	16	G	30	26	1942			C	g, a
7e	do.	1943	700	66.0	16	G		22.6	1949			C	a
7f	do.	1943	700	68.0	16	G		26	1943			C	a

[1] AQUIFER: G, Pleistocene and Recent; C, Conemaugh; A, Allegheny; P, Pottsville.
[2] USE OF WATER: A, air conditioning; C, cooling; D, domestic; F, fire protection; G, general; I, industrial; P, public supply.
[3] DATA AVAILABLE: a, analysis; g, log; p, pumping test.

TABLE 10. *Continued*

MAP NUMBER	OWNER OR TENANT	YEAR COMPLETED	SURFACE ELEVATION (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)	AQUIFER[1]	THICKNESS OF AQUIFER (feet)	WATER LEVEL		YIELD		USE OF WATER[2]	DATA AVAILABLE[3]
								DEPTH TO WATER LEVEL (feet)	DATE OF MEASUREMENT	YIELD OF WELL (gpm)	DATE OF MEASUREMENT		
8a	Beaver Borough	1923	680	40	6	G						P	a
8b	do.	1923	680	40	6	G						P	
8c	do.	1947	692	67.0	12	G	34	12	1947	910	1947	P	g, p
8d	do.	1947	692	61.0	12	G	34	12	1947	960	1947	P	g, a, p
8e	do.	1947	692	61.5	12	G	43.5	12	1947	960	1947	P	g, p
9a	Beaver Ice Co.	1928	780	150	10	G		60				C	
9b	do.	1928	780	150	10	G		60				C	
10a	Borough Municipal Authority	1941	754.7	119.0	12	G	113.0	72	1941	610	1941	P	g, p
10b	do.	1941	754.7	119.5	12	G	114.5	72	1941	720	1941	P	g, a, p
10c	do.	1941	754.7	118.5	12	G	114.5	72	1941	640	1941	P	g, p
11a	Monongahela Land Co.	1929	770	165.6	4	A		90				P	
11b	do.	1943	770	126.0	8	G		91.0	1943			P	a
12	Treadwell Construction Co.	1941	698	60.0	10	G		35.0	1948	195	1941	D, C	a, p
13a	MacIntosh Hemphill Co.	1941	775	62.0	10	G		45	1948			C	
13b	do.	1941	775	62.0	10	G		45	1948			C	
14	Midland Slag Co.	1945	750	126	10	G		60				C, I	
15a	Koppers Co. (Kobuta Plant)	1942	753.7	113.7	16	G	79	69.8	1942			F, D	g
15b	do.	1942	759.2	121.0	16	G	112	76.5	1942	835	1942		g, p
15c	do.	1942	752.7	111.3	16	G	100	67.0	1942	800	1942		g, p
15d	do.	1942	740	103.0	12	G		48.0	1942			D, F	
15e	do.	1945	740	107.0	16, 12	G	75	58.0	1944	410	1944		g, p
16a	Beaver County Home	1920	760	165	6	G		70				D, G	
16b	do.	1931	760	140	8, 6	G		70				D, G	
17a	St. Josephs Lead Co.	1930	672	30.0	12	G						G	
17b	do.	1941	678	52.0	12	G						G	a
17c	do.	1947	788	152.0	12	G		107.0	1947	1,380	1947	G	a, p
17d	do.	1947	788	153.0	13	G		107.0	1947			G	
18a	Monaca Borough		680	45	10	G		5				P	
18b	do.		680	45	10	G		5				P	
18c	do.	1933	680	47.0	10	G	25	5		105	1933	P	g, a, p
18d	do.	1933	680	45	10	G		5		250	1933	P	p
18e	do.	1933	680	49.0	10	G	27	5		225	1933	P	g, p

[1] AQUIFER: G, Pleistocene and Recent; C, Conemaugh; A, Allegheny; P, Pottsville.
[2] USE OF WATER: A, air conditioning; C, cooling; D, domestic; F, fire protection; G, general; I, industrial; P, public supply.
[3] DATA AVAILABLE: a, analysis; g, log; p, pumping test.

TABLE 10. *Continued*

MAP NUMBER	OWNER OR TENANT	YEAR COMPLETED	SURFACE ELEVATION (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)	AQUIFER[1]	THICKNESS OF AQUIFER (feet)	WATER LEVEL		YIELD		USE OF WATER[2]	DATA AVAILABLE[3]
								DEPTH TO WATER LEVEL (feet)	DATE OF MEASUREMENT	YIELD OF WELL (gpm)	DATE OF MEASUREMENT		
18f	do.	1933	680	50.0	10	G	28	5		175	1933	P	g, p
18g	do.	1933	680	45	10	G		5		200	1933	P	p
18h	do.	1933	680	45.0	10	G	35	5		150	1933	P	g, p
18i	do.	1933	680	46.0	10	G	21	5		135	1933	P	g, p
18j	do.	1933	680	43.0	10	G	28	5		142	1933	P	g, p
19	Phoenix Glass Co.	1910	740	103.0	12	G		32.0	1947	200	1947	G, D	p
20	Richmond Radiator Co.	1920	730	94	8	G		57.0	1938	125	1938	D, I, F	p
21	Pittsburgh Tube Co.	1941	740	105.0	16	G	81	60.0	1942	575	1942	C	g, p
22	Pittsburgh & Lake Erie Railroad	1932	702	76.0	8	G	34	25.5	1932			D	g, a
23a	Vanadium Alloy Co.	1921	754	105.0	9, 6	G		78				D	a
23b	do.	1900	755	100		G		78				D	
24	Vulcan Crucible Steel Co.		740	93.0	6	G		59.25	1944			D	
25a	West Aliquippa Borough	1945	741	98.0	16	G	23	60.0	1945	820	1945	P	g, a, p
25b	do.	1945	743	102.0	16	G	35	58.0	1945	860	1945	P	g, p
26a	Woodlawn Water Co.	1939	727.5	85.0	16	G	22	44.0	1939	575	1939	P	g, a, p
26b	do.	1939	731.0	87.0	16	G	26	48	1939	615	1939	P	g, a, p
26c	do.	1940	732.0	88.0	16	G	25	50.0	1939	590	1939	P	g, a, p
26d	do.	1940	726.0	83.0	16	G	24	45.7	1940	575	1940	P	g, a, p
26e	do.	1942	728.0	80.5	16	G	21	47.0	1942	600	1942	P, I	g, p
26f	do.	1945	732.5	89.5	16	G	22.5	52.0	1944	745	1945	P	g, p
26g	do.	1949	733	91	24, 16	G	20	54	1949	1,000	1949	P	g, p
26h	Woodlawn Water Co.	1942	733	80	24, 16	G	15					P	g
26i	do.	1942	733	80	24, 16	G	20					P	g
27	Jones & Laughlin Steel Co.	1923	684	42	10	G						F, I	a
28a	South Heights Water Co.	1924	742	97.0	8	G		59.0	1924			P, F	a
28b	do.	1935	742	97	8	G		60	1948			P	a
29	Standard Specialty & Tube Co.		730	74.0	6	G		59.0	1942			D	
30	Rochester Pipe Products Co.	1900	745	70	6	G		50				D	
31	Union Drawn Steel		730	90.0	8	G		60	1941			D	
32	Fame Laundries Co.	1908	740	100	5	G		12				I	a
33	Andalusia Dairy Co.	1935	740	95	8	G		flowing		40		C	a
34	Petroleum Solvents Co.	1946	705	75	12, 8	P						I	g

[1] AQUIFER: G, Pleistocene and Recent; C, Conemaugh; A, Allegheny; P, Pottsville.
[2] USE OF WATER: A, air conditioning; C, cooling; D, domestic; F, fire protection; G, general; I, industrial; P, public supply.
[3] DATA AVAILABLE: a, analysis; g, log; p, pumping test.

TABLE 10. *Continued*

MAP NUMBER	OWNER OR TENANT	YEAR COMPLETED	SURFACE ELEVATION *(feet)*	DEPTH OF WELL *(feet)*	DIAMETER OF WELL *(inches)*	AQUIFER[1]	THICKNESS OF AQUIFER *(feet)*	WATER LEVEL		YIELD		USE OF WATER[2]	DATA AVAILABLE[3]
								DEPTH TO WATER LEVEL *(feet)*	DATE OF MEASUREMENT	YIELD OF WELL *(gpm)*	DATE OF MEASUREMENT		
35	Industry School	1940	750	66	8	A						D, I	
36	Midland Ice Co.	1920	830	175	6	A						I	
37	Kidd Drawn Steel Co.	1917	740	150	8	A		60				D	
38	Center Township Fire Dept.	1944	1,130	110	6	C		50	1944	0.25		D	
39	Aliquippa Ice Co.	1933	840	100	8	A	15			50		C	
40a	Sutherland Dairy Co.	1940	900	190	8	A				40		C	
40b	do.	1949	900	210	8	A				45		C	
41	Aliquippa Golf Club	1940	820	65	10	A		22	1940	45	1940	D	
42	Pettibon Dairy Co.	1947	860	135	12	A		25	1947	10		C	
43	Pittsburgh Bridge & Iron Works	1919	920	105	8	A		45		15		D	
44	William Leard Co.	1900	745	150	8	P				40		D	
45	Sterling Borax Co.	1900	780	180	6	P						I, D	
46	Brighton Fire Brick Co.	1900	800	175	4	P				10		I, G	
47a	Mayer China Co.	1946	740	50	12	P		45		15		I	
47b	do.	1946	740	50	12	P		45		20		I	
47c	do.	1946	740	50	12	P		45		20		I	
47d	do.	1947	740	35	8	P		45		20		I	
47e	do.	1948	740	51	12	P		45		20		I	
48a	Brodhead Hotel	1926	810	125	6	P		80.0	1948	30		D, C	
48b	do.	1926	810	125	6	P		80.0	1948	30		D, C	
49a	Frumen's Dairy	1941	920	105	8	P		70		50		C, D	
49b	do.	1944	920	105	8	P		70		50		C, D	
50a	Koppel Borough	1920	920	76	6	P		38		50		P	
50b	do.	1943	960	60	8	A		12		50		P	
51	Ellwood Stone Co.	1945	860	50	6	P		20		50		D	
52	Camp Kon-o-Kwee	1941	925	102	8	A		35	1941	30	1941	D, I	
53	New Castle Refractories Co.	1920	970	180	6	A		80		10		I	
54	Malvern Fireproofing Corp.	1949	880	35	8	G		15				I, D	

[1] AQUIFER: G, Pleistocene and Recent; C, Conemaugh; A, Allegheny; P, Pottsville.
[2] USE OF WATER: A, air conditioning; C, cooling; D, domestic; F, fire protection; G, general; I, industrial; P, public supply.
[3] DATA AVAILABLE: a, analysis; g, log; p, pumping test.

RECORDS OF WELLS IN BEAVER COUNTY[6]

1a[7], AMERICAN BRIDGE CO., Ambridge. Drilled in 1939 by Ohio Drilling Co. USAGE: Cooling, general.

SURFACE ELEVATION: 711.0 feet. Top of casing at land surface.

DIAMETER OF CASING: 36 to 18 inches. 20 feet of screen at bottom.

DEPTH: 64.0 feet below land surface.

DRILLER'S LOG

	FEET
Slag	0—18
Clay, sand, and silt	18—34
Clay and stones	34—37
Gravel, sand, and clay	37—45
Gravel and sand	45—64
Shale	64—64 +

CHEMICAL ANALYSIS

Aug. 15, 1942

	PARTS PER MILLION *(except color and pH)*
Iron (Fe)	0.0
Manganese (Mn)	1.6
Magnesium (Mg as $CaCO_3$)	70
Sulfate (SO_4)	120
Chloride (Cl)	30
Alkalinity (as $CaCO_3$)	189
Total solids	478
Free CO_2	75
Total hardness (as $CaCO_3$)	383
Color	0
Ignition loss	125
Hydrogen-ion concentration (pH)	7.4

INSTALLATION: Turbine pump; capacity, 1,000 gpm; motor, 40 hp.

PUMPING TEST

DATE: 1939.
DURATION: 8 hours.
STATIC LEVEL: 29 feet.
DRAWDOWN: 15 feet.
YIELD: 1,500 gpm.
SPECIFIC CAPACITY: 100 gpm/ft.

PRODUCTION: 672,000 gpd, total for wells 1a, 1b, and 1c alternating.

TEMPERATURE: 53° F.

WATER LEVEL: 29.0 feet below land surface October 1939.

1b, AMERICAN BRIDGE CO., Ambridge. Drilled in 1939 by Ohio Drilling Co. USAGE: Cooling, general.

SURFACE ELEVATION: 711.0 feet. Top of casing at land surface.

DIAMETER OF CASING: 36 to 18 inches. 20 feet of screen at bottom.

DEPTH: 65.0 feet below land surface.

DRILLER'S LOG

	FEET
Slag and ashes	0—20
Clay, sand, and silt	20—30
Clay and stones	30—35
Sand, gravel, and a little clay	35—45
Sand and gravel	45—61
Sand, gravel, and clay	61—62
Shale	62—62 +

[6] (The following data were supplied by industries and well drillers. Drillers' logs are presented as obtained from drillers' records. Unless otherwise indicated, source of chemical analyses, and dates of temperature determinations and water levels are not known. Wells obtain water from Pleistocene and Recent sediments except where bedrock aquifer is given).

[7] Numbers refer to locations on map, Plate 1.

INSTALLATION: Turbine pump; capacity 600 gpm; motor, 20 hp.

PUMPING TEST

DATE: 1939.	DRAWDOWN: 23 feet.
DURATION: 8 hours.	YIELD: 900 gpm.
STATIC LEVEL: 28.5 feet.	SPECIFIC CAPACITY: 39.1 gpm/ft.

PRODUCTION: 672,000 gpd, total for wells 1a, 1b, and 1c, alternating.
TEMPERATURE: 53° F.
WATER LEVEL: 28.5 feet below land surface November 1939.

1c, AMERICAN BRIDGE CO., Ambridge. Drilled in 1939 by Ohio Drilling Co. USAGE: Cooling, general.

SURFACE ELEVATION: 711.0 feet. Top of casing at land surface.
DIAMETER OF CASING: 36 to 18 inches. 20 feet of screen at bottom.
DEPTH: 60.0 feet below land surface.

DRILLER'S LOG

	FEET
Ashes and fill	0—15
Clay, sand, and silt	15—30
Clay and stones	30—35
Gravel, sand, and clay	35—38
Sand and gravel	38—55
Clay and stones	55—56
Shale	56—56 +

INSTALLATION: Turbine pump; capacity 1,000 gpm; motor, 40 hp.

PUMPING TEST

DATE: 1939.	DRAWDOWN: 12.5 feet.
DURATION: 8 hours.	YIELD: 1,200 gpm.
STATIC LEVEL: 24.5 feet.	SPECIFIC CAPACITY: 96.0 gpm/ft.

PRODUCTION: 672,000 gpd, total for wells 1a, 1b, and 1c, alternating.
TEMPERATURE: 53° F.
WATER LEVEL: 24.5 feet below land surface December 1939.

1d, AMERICAN BRIDGE CO., Ambridge. Drilled in 1942 by Ohio Drilling Co. USAGE: Drinking.

SURFACE ELEVATION: 711.0 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 inches. 15 feet of screen at bottom.
DEPTH: 66.0 feet below land surface.

DRILLER'S LOG

	FEET
Ashes and fill	0— 3
Soft, yellow, sandy clay	3—25
Soft, blue, sandy clay	25—31
Clay and stones	31—35
Sand, gravel, and a little clay	35—50
Sand and gravel	50—60
Sand, gravel, and a little clay	60—66
Shale	66—66 +

INSTALLATION: Turbine pump; capacity 100 gpm; motor, 7½ hp.

PUMPING TEST

DATE: 1942.	DRAWDOWN: 9 feet.
DURATION: 8 hours.	YIELD: 100 gpm.
STATIC LEVEL: 31 feet.	SPECIFIC CAPACITY: 11.1 gpm/ft.

PRODUCTION: 25,000 gpd, operating 4¼ hours/day.
TEMPERATURE: 53° F.
WATER LEVEL: 31.0 feet below land surface February 1942.

2a, NATIONAL ELECTRIC PRODUCTS CORP., Ambridge. Drilled about 1916. USAGE: Boilers, cooling.

SURFACE ELEVATION: 757 feet. Top of casing at land surface.
DIAMETER OF CASING: 10 inches.
DEPTH: 147 feet below land surface.
AQUIFER: Conemaugh group.

CHEMICAL ANALYSIS

Oct. 11, 1943

	PARTS PER MILLION *(except pH)*
Silica (SiO_2)	11
Calcium (Ca)	82
Magnesium (Mg)	14
Carbonate (CO_3)	0
Bicarbonate (HCO_3)	325
Sulfate (SO_4)	197
Chloride (Cl)	364
Hardness (as $CaCO_3$)	265
Hydrogen-ion concentration (pH)	7.6

INSTALLATION: Turbine pump; capacity 100 gpm; motor, 7½ hp.

PRODUCTION: Not in use.
TEMPERATURE: 52° F.
WATER LEVEL: Not known.

2b, NATIONAL ELECTRIC PRODUCTS CORP., Ambridge. Drilled in 1923 by Dunbar Drilling Co. USAGE: Boilers, cooling.

SURFACE ELEVATION: 755 feet. Top of casing at land surface.
DIAMETER OF CASING: 10 inches.
DEPTH: 100 feet below land surface.

CHEMICAL ANALYSIS

Oct. 11, 1943

	PARTS PER MILLION *(except pH)*
Silica (SiO_2)	12
Calcium (Ca)	96
Magnesium (Mg)	33
Carbonate (CO_3)	0
Bicarbonate (HCO_3)	96
Sulfate (SO_4)	325
Chloride (Cl)	59
Hardness (as $CaCO_3$)	376
Hydrogen-ion concentration (pH)	6.2

INSTALLATION: Turbine pump; capacity 225 gpm.

PUMPING TEST

DATE: 1943.	DRAWDOWN: 12 feet.
DURATION: 48 hours.	YIELD: 275 gpm.
STATIC LEVEL: 74 feet.	SPECIFIC CAPACITY: 23 gpm/ft.

PRODUCTION: 266,000 gpd, operating 24 hours/day.
TEMPERATURE: 52° F.
WATER LEVEL: 74 feet below land surface in 1943.

2c, NATIONAL ELECTRIC PRODUCTS CORP., Ambridge. Drilled in 1943 by Dunbar Drilling Co. USAGE: Cooling.

SURFACE ELEVATION: 755 feet. Top of casing at land surface.
DIAMETER OF CASING: 36 to 12 inches.
DEPTH: 104.2 feet below land surface.

CHEMICAL ANALYSIS

Oct. 11, 1943

	PARTS PER MILLION (except pH)
Silica (SiO_2)	13
Calcium (Ca)	65
Magnesium (Mg)	29
Carbonate (CO_3)	0
Bicarbonate (HCO_3)	63
Sulfate (SO_4)	188
Chloride (Cl)	60
Hardness (as $CaCO_3$)	282
Hydrogen-ion concentration (pH)	6.1

INSTALLATION: Turbine pump; capacity 250 gpm.

PUMPING TEST

DATE: 1943. DRAWDOWN: 16 feet.
DURATION: 48 hours. YIELD: 375 gpm.
STATIC LEVEL: 74 feet. SPECIFIC CAPACITY: 23.4 gpm/ft.

PRODUCTION: 360,000 gpd, operating 24 hours/day.
TEMPERATURE: 52° F.
WATER LEVEL: 74 feet below land surface in 1943.

2d, NATIONAL ELECTRIC PRODUCTS CORP., Ambridge. Drilled in 1948 by Dunbar Drilling Co. USAGE: Cooling.

SURFACE ELEVATION: 755 feet. Top of casing at land surface.
DIAMETER OF CASING: 20 inches. 20 feet of screen at bottom.
DEPTH: 106.5 feet below land surface.

DRILLER'S LOG

	FEET
Sand, gravel, and clay	0— 72
Sand and gravel	72—107
Shale	107—110

INSTALLATION: Turbine pump; capacity 250 gpm; motor, 20 hp.

PUMPING TEST

DATE: 1948. DRAWDOWN: 28 feet.
DURATION: 18 hours. YIELD: 450 gpm.
STATIC LEVEL: 72 feet. SPECIFIC CAPACITY: 16.1 gpm/ft.

PRODUCTION: 360,000 gpd, operating 24 hours/day.
TEMPERATURE: 52° F.
WATER LEVEL: 72 feet below land surface July 2, 1948.

3a, AMBRIDGE BOROUGH, Ambridge. Drilled in 1945 by Pennsylvania Drilling Co. USAGE: Municipal supply.

SURFACE ELEVATION: 691.5 feet. Top of casing at land surface.
DIAMETER OF CASING: 13 inches. 12 feet of screen at bottom.
DEPTH: 42.6 feet below land surface.

DRILLER'S LOG

	FEET
Sand and clay	0—18
Coarse sand	18—24
Sand and gravel	24—27
Coarse sand	27—31
Fine sand and gravel	31—36
Clay and fine gravel	36—42.6

CHEMICAL ANALYSIS

Sept. 30, 1945

By AMBRIDGE WATER DEPARTMENT

	PARTS PER MILLION *(except pH)*
Iron (Fe)	trace
Manganese (Mn)	1.4
Calcium (Ca)	73
Magnesium (Mg)	12
Sulfate (SO_4)	25
Chloride (Cl)	17
Alkalinity (as $CaCO_3$)	220
Total solids	260
Free CO_2	6
Hardness (as $CaCO_3$)	231
Ignition loss	40
Hydrogen-ion concentration (pH)	7.6

CHEMICAL ANALYSIS

(Composite sample from wells 3a to 3h)

Mar. 10, 1947

By AMBRIDGE WATER DEPARTMENT

	PARTS PER MILLION *(except pH)*
Silica (SiO_2)	8.0
Iron (Fe)	trace
Manganese (Mn)	0.5
Calcium (Ca)	54.0
Magnesium (Mg)	6.1
Sodium (Na)	12.0
Sulfate (SO_4)	105.3
Chloride (Cl)	22
Alkalinity (as $CaCO_3$)	72
Total solids	325
Free CO_2	5.0
Aluminum (Al)	1.8
Hardness (as $CaCO_3$)	188
Ignition loss	40
Hydrogen-ion concentration (pH)	7.4

INSTALLATION: Turbine pump; capacity 500 gpm; motor, 15 hp.

PUMPING TEST

DATE: 1945.
DURATION: 24 hours.
STATIC LEVEL: 1.5 feet.
DRAWDOWN: 18 feet.
YIELD: 518 gpm.
SPECIFIC CAPACITY: 28.8 gpm/ft.

PRODUCTION: 2,670,000 gpd, total for wells 3a to 3h, operating as a unit.
TEMPERATURE: 52° F.
WATER LEVEL: 1.5 feet below land surface September 28, 1945.

3b, AMBRIDGE BOROUGH, Ambridge. Drilled in 1945 by Pennsylvania Drilling Co. USAGE: Municipal supply.

SURFACE ELEVATION: 695.5 feet. Top of casing at land surface.
DIAMETER OF CASING: 13 inches. 12 feet of screen at bottom.
DEPTH: 50.67 feet below land surface.

DRILLER'S LOG

	FEET
Clay	0—21
River mud	21—25
Sand and gravel	25—31
Fine gravel	31—35
Fine sand	35—38
Fine sand and gravel	38—44
Coarse sand and gravel	44—48
Clay and gravel	48—50.67

CHEMICAL ANALYSIS

Aug. 27, 1945

By AMBRIDGE WATER DEPARTMENT

	PARTS PER MILLION *(except pH)*
Iron (Fe)	trace
Manganese (Mn)	0
Calcium (Ca)	86
Magnesium (Mg)	9.8
Sulfate (SO_4)	72
Chloride (Cl)	19
Alkalinity (as $CaCO_3$)	176
Total solids	330
Free CO_2	8
Hardness (as $CaCO_3$)	255
Ignition loss	90
Hydrogen-ion concentration (pH)	7.3

INSTALLATION: Turbine pump; capacity 500 gpm; motor, 15 hp.

PUMPING TEST

DATE: 1945.
DURATION: 23 hours.
STATIC LEVEL: 12.1 feet.
DRAWDOWN: 21.75 feet.
YIELD: 465 gpm.
SPECIFIC CAPACITY: 21.4 gpm/ft.

PRODUCTION: 2,670,000 gpd, total for wells 3a to 3h, operating as a unit.
TEMPERATURE: 67° F. on November 10, 1949.
WATER LEVEL: 12.1 feet below land surface August 25, 1945.

3c, AMBRIDGE BOROUGH, Ambridge. Drilled in 1945 by Pennsylvania Drilling Co.
USAGE: Municipal supply.
SURFACE ELEVATION: 691.6 feet. Top of casing at land surface.
DIAMETER OF CASING: 13 inches. 12 feet of screen at bottom.
DEPTH: 44.3 feet below land surface.

DRILLER'S LOG

	FEET
Sand and gravel	0— 2
River mud	2— 6.3
Clay	6.3— 9.3
Sand and gravel	9.3—17.3
Coarse sand	17.3—20.3
Sand and gravel	20.3—26.3
Coarse sand	26.3—34.3
Fine sand	34.3—40.3
Coarse sand and gravel	40.3—44.4

CHEMICAL ANALYSIS

Aug. 9, 1945

By AMBRIDGE WATER DEPARTMENT

	PARTS PER MILLION *(except pH)*
Iron (Fe)	trace
Manganese (Mn)	0
Calcium (Ca)	90
Magnesium (Mg)	12
Sulfate (SO_4)	95
Chloride (Cl)	37
Alkalinity (as $CaCO_3$)	165
Total solids	410
Free CO_2	11
Hardness (as $CaCO_3$)	274
Ignition loss	100
Hydrogen-ion concentration (pH)	7.2

INSTALLATION: Turbine pump; capacity 500 gpm; motor, 15 hp.

PUMPING TEST

DATE: 1945.	DRAWDOWN: 16.25 feet.
DURATION: 14 hours.	YIELD: 440 gpm.
STATIC LEVEL: 8.1 feet.	SPECIFIC CAPACITY: 27.1 gpm/ft.

PRODUCTION: 2,670,000 gpd, total for wells 3a to 3h, operating as a unit.
TEMPERATURE: 52° F.
WATER LEVEL: 8.1 feet below land surface August 8, 1945.

3d, AMBRIDGE BOROUGH, Ambridge. Drilled in 1945 by Pennsylvania Drilling Co.
USAGE: Municipal supply.

SURFACE ELEVATION: 691.5 feet. Top of casing at land surface.
DIAMETER OF CASING: 13 inches. 13 feet of screen at bottom.
DEPTH: 45.5 feet below land surface.

DRILLER'S LOG

	FEET
Sand and gravel	0 —12
Sand, gravel, and clay	12 —16
Fine sand	16 —19
Coarse sand	19 —23
Hard gravel	23 —29
Fine gravel	29 —35
Sand and gravel	35 —41
Black gravel	41 —45.5
Rock	45.5—45.5 +

CHEMICAL ANALYSIS

July 27, 1945

BY AMBRIDGE WATER DEPARTMENT

	PARTS PER MILLION *(except pH)*
Iron (Fe)	trace
Manganese (Mn)	0
Calcium (Ca)	107
Magnesium (Mg)	13
Sulfate (SO_4)	107
Chloride (Cl)	19
Alkalinity (as $CaCO_3$)	204
Total solids	440
Free CO_2	40
Hardness (as $CaCO_3$)	320
Ignition loss	130
Hydrogen-ion concentration (pH)	7.3

INSTALLATION: Turbine pump; capacity 500 gpm; motor, 15 hp.

PUMPING TEST

DATE: 1945.	DRAWDOWN: 17.75 feet.
DURATION: 14 hours.	YIELD: 500 gpm.
STATIC LEVEL: 8.5 feet.	SPECIFIC CAPACITY: 28.2 gpm/ft.

PRODUCTION: 2,670,000 gpd, total for wells 3a to 3h, operating as a unit.
TEMPERATURE: 52° F.
WATER LEVEL: 8.5 feet below land surface July 26, 1945.

3e, AMBRIDGE BOROUGH, Ambridge. Drilled in 1945 by Pennsylvania Drilling Co.
USAGE: Municipal supply.

SURFACE ELEVATION: 691.6 feet. Top of casing at land surface.
DIAMETER OF CASING: 13 inches. 14 feet of screen at bottom.
DEPTH: 43.6 feet below land surface.

DRILLER'S LOG

	FEET
Sand	0— 7
Fine sand and gravel	7—10
Coarse sand and gravel	10—37
Coarse black sand and gravel	37—43.6

CHEMICAL ANALYSIS

June 28, 1945

By AMBRIDGE WATER DEPARTMENT

	PARTS PER MILLION *(except pH)*
Iron (Fe)	0
Manganese (Mn)	0
Calcium (Ca)	122
Magnesium (Mg)	10
Sulfate (SO_4)	137
Chloride (Cl)	19.5
Alkalinity (as $CaCO_3$)	202
Total solids	480
Free CO_2	33.5
Hardness (as $CaCO_3$)	346
Ignition loss	90
Hydrogen-ion concentration (pH)	7.2

INSTALLATION: Turbine pump; capacity 500 gpm; motor, 15 hp.

PUMPING TEST

DATE: 1945.
DURATION: 15 hours.
STATIC LEVEL: 6.1 feet.
DRAWDOWN: 15.5 feet.
YIELD: 500 gpm.
SPECIFIC CAPACITY: 32.3 gpm/ft.

PRODUCTION: 2,670,000 gpd, total for wells 3a to 3h, operating as a unit.
TEMPERATURE: 52° F.
WATER LEVEL: 6.1 feet below land surface June 27, 1945.

3f, AMBRIDGE BOROUGH, Ambridge. Drilled in 1945 by Pennsylvania Drilling Co.
USAGE: Municipal supply.

SURFACE ELEVATION: 696.2 feet. Top of casing at land surface.
DIAMETER OF CASING: 13 inches. 13 feet of screen at bottom.
DEPTH: 52.16 feet below land surface.

DRILLER'S LOG

	FEET
Clay	0— 8
Sand	8—15
Fine sand and gravel	15—18
Coarse sand and gravel	18—46
Coarse black sand and gravel	46—52.2

INSTALLATION: Turbine pump; capacity 500 gpm; motor, 15 hp.

PUMPING TEST

DATE: 1945.
DURATION: 14 hours.
STATIC LEVEL: 13.9 feet.
DRAWDOWN: 15.5 feet.
YIELD: 500 gpm.
SPECIFIC CAPACITY: 32.3 gpm/ft.

PRODUCTION: 2,670,000 gpd, total for wells 3a to 3h, operating as a unit.
TEMPERATURE: 52° F.
WATER LEVEL: 13.9 feet below land surface June 11, 1945.

3g, AMBRIDGE BOROUGH, Ambridge. Drilled in 1945 by Pennsylvania Drilling Co.
USAGE: Municipal supply.

SURFACE ELEVATION: 698.3 feet. Top of casing at land surface.
DIAMETER OF CASING: 13 inches. 13 feet of screen at bottom.
DEPTH: 52.16 feet below land surface.

DRILLER'S LOG

	FEET
Iron and cement	0—10
Slag	10—17
Sand and clay	17—27
Fine sand and gravel	27—37
Gravel	37—47
Fine sand	47—54
White clay and gravel	54—56.6

CHEMICAL ANALYSIS

Oct. 18, 1945

By AMBRIDGE WATER DEPARTMENT

	PARTS PER MILLION *(except pH)*
Iron (Fe)	0
Manganese (Mn)	0
Calcium (Ca)	145
Magnesium (Mg)	16
Sulfate (SO_4)	164
Chloride (Cl)	18
Alkalinity (as $CaCO_3$)	225
Total solids	520
Free CO_2	13
Hardness (as $CaCO_3$)	428
Ignition loss	90
Hydrogen-ion concentration (pH)	7.2

INSTALLATION: Turbine pump; capacity 400 gpm; motor, 15 hp.

PUMPING TEST

DATE: 1945. DRAWDOWN: 17 feet.
DURATION: 24 hours. YIELD: 585 gpm.
STATIC LEVEL: 16.25 feet. SPECIFIC CAPACITY: 34.4 gpm/ft.

PRODUCTION: 2,670,000 gpd, total for wells 3a to 3h, operating as a unit.
TEMPERATURE: 50° F.
WATER LEVEL: 16.25 feet below land surface October 17, 1945.

3h, AMBRIDGE BOROUGH, Ambridge. Drilled in 1945 by Pennsylvania Drilling Co.
USAGE: Municipal supply.

SURFACE ELEVATION: 701.2 feet. Top of casing at land surface.
DIAMETER OF CASING: 13 inches. 13.2 feet of screen at bottom.
DEPTH: 58.0 feet below land surface.

DRILLER'S LOG

	FEET
Soil	0— 8
Slag and skulls	8—29
Sand and clay	29—33
Fine sand	33—41
Coarse gravel	41—53
Large gravel	53—65
Gray sand	65—69

CHEMICAL ANALYSIS

Nov. 6, 1945

By AMBRIDGE WATER DEPARTMENT

	PARTS PER MILLION *(except pH)*
Iron (Fe)	0
Manganese (Mn)	0
Calcium (Ca)	175
Magnesium (Mg)	24
Sulfate (SO_4)	214
Chloride (Cl)	18
Alkalinity (as $CaCO_3$)	253
Total solids	670
Free CO_2	20
Hardness (as $CaCO_3$)	528
Ignition loss	150
Hydrogen-ion concentration (pH)	7.2

INSTALLATION: Turbine pump; capacity 400 gpm; motor, 15 hp.

PUMPING TEST

DATE: 1945.	DRAWDOWN: 19 feet.
DURATION: 21 hours.	YIELD: 565 gpm.
STATIC LEVEL: 19.0 feet.	SPECIFIC CAPACITY: 29.7 gpm/ft.

PRODUCTION: 2,670,000 gpd, total for wells 3a to 3h, operating as a unit.
TEMPERATURE: 50° F.
WATER LEVEL: 19.0 feet below land surface November 5, 1945.

4a, NATIONAL SUPPLY CO. (Spang-Chalfant Division), Ambridge. Drilled in 1916 by James Kinney, Jr. USAGE: Drinking, sanitation.

SURFACE ELEVATION: 748 feet. Top of casing at land surface.
DIAMETER OF CASING: 10 inches.
DEPTH: 210 feet below land surface.
AQUIFER: Allegheny group.

INSTALLATION: Air lift pump.
PRODUCTION: 108,000 gpd, operating 12 hours/day.

4b, NATIONAL SUPPLY CO. (Spang-Chalfant Division), Ambridge. Drilled in 1916 by James Kinney, Jr. USAGE: Drinking, sanitation.

SURFACE ELEVATION: 748 feet. Top of casing at land surface.
DIAMETER OF CASING: 10 inches.
DEPTH: 210 feet below land surface.
AQUIFER: Allegheny group.

INSTALLATION: Air lift pump.
PRODUCTION: 108,000 gpd, operating 12 hours/day.

4c, NATIONAL SUPPLY CO. (Spang-Chalfant Division), Ambridge. Drilled in 1916 by Charles Springer. USAGE: Drinking, sanitation.

SURFACE ELEVATION: 748 feet. Top of casing at land surface.
DIAMETER OF CASING: 4¾ inches.
DEPTH: 94.0 feet below land surface.

INSTALLATION: Turbine pump; motor, 15 hp.
PRODUCTION: 17,520 gpd, operating 8 hours/day.

4d, NATIONAL SUPPLY CO. (Spang-Chalfant Division), Ambridge. Drilled in 1917 by Charles Springer. USAGE: Drinking, sanitation.

SURFACE ELEVATION: 748 feet. Top of casing at land surface.
DIAMETER OF CASING: 4¾ inches.
DEPTH: 107.0 feet below land surface.

INSTALLATION: Turbine pump; motor, 15 hp.
PRODUCTION: 17,520 gpd, operating 8 hours/day.

4e, NATIONAL SUPPLY CO. (Spang-Chalfant Division), Ambridge. Drilled in 1942 by Layne-New York Co., Inc. USAGE: Drinking, sanitation.

SURFACE ELEVATION: 758 feet. Top of casing 3.5 feet above surface.
DIAMETER OF CASING: 24 to 12 inches. 15 feet of screen at bottom.
DEPTH: 108.0 feet below land surface.

DRILLER'S LOG

	FEET
Topsoil	0— 1
Brown sand	1— 6
Brown sand and gravel	6— 14
Sand and gravel	14— 68
Sand and clay	68— 70
Sand and gravel	70—106
Gray sand	106—110
Slate rock	110—111

INSTALLATION: Turbine pump; motor, 30 hp.

PUMPING TEST

DATE: 1942. YIELD: 350 gpm.
STATIC LEVEL: 73.5 feet. SPECIFIC CAPACITY: 17.1 gpm/ft.
DRAWDOWN: 20.5 feet.

PRODUCTION: 226,800 gpd, operating 12 hours/day.
WATER LEVEL: 73.5 feet below land surface August 10, 1942.

4f, NATIONAL SUPPLY CO. (Spang-Chalfant Division), Ambridge. Drilled in 1943 by Layne-New York Co., Inc. USAGE: Drinking, sanitation.

SURFACE ELEVATION: 758 feet. Top of casing 0.75 feet above surface.
DIAMETER OF CASING: 24 to 12 inches. 15 feet of screen at bottom.
DEPTH: 109.0 feet below land surface.

DRILLER'S LOG

	FEET
Fill	0— 4
Sandy yellow clay	4— 10
Brown sand and gravel	10— 28
Coal	28— 30
Brown sand and gravel	30— 80
Coarse sand and gravel	80— 97
Shale	97— 98
Brown sand and gravel	98—102
Gravel and gray sand	102—111

INSTALLATION: Turbine pump; motor, 30 hp.

PUMPING TEST

DATE: 1943. YIELD: 268 gpm.
STATIC LEVEL: 79 feet. SPECIFIC CAPACITY: 9.6 gpm/ft.
DRAWDOWN: 28 feet.

PRODUCTION: 187,000 gpd., operating 12 hours/day.
WATER LEVEL: 79.0 feet below land surface January 21, 1944.

4g, NATIONAL SUPPLY CO. (Spang-Chalfant Division), Ambridge. Drilled in 1944 by Layne-New York Co., Inc. USAGE: Drinking, sanitation.

SURFACE ELEVATION: 718 feet. Top of casing at land surface.
DIAMETER OF CASING: 12 to 8 inches. 15 feet of screen at bottom.
DEPTH: 73.5 feet below land surface.

DRILLER'S LOG

	FEET
Fill	0 —12.5
Topsoil	12.5—13.5
Gray clay	13.5—22.5
Yellow clay and gravel	22.5—26.5
Gravel and sand	26.5—31.5
Clay, gravel, and sand	31.5—41.5
Gray clay and gravel	41.5—43.5
Yellow clay, gravel, and gray sand	43.5—50
Coarse gravel, and sharp brown and gray sand	50 —73.5

INSTALLATION: Turbine pump; motor, 30 hp.

PUMPING TEST

DATE: 1944. YIELD: 255 gpm.
STATIC LEVEL: 40.25 feet. SPECIFIC CAPACITY: 15.9 gpm/ft.
DRAWDOWN: 16 feet.

PRODUCTION: 126,000 gpd, operating 12 hours/day.
WATER LEVEL: 40.25 feet below land surface August 26, 1944.

5, BADEN BOROUGH, Crow Island, Baden. Ten wells drilled before 1928. USAGE: Municipal supply.

SURFACE ELEVATION: 678 feet. Top of casings below river surface.
DIAMETER OF CASING: 8 inches.
DEPTH: 40 feet below land surface.

INSTALLATION: Turbine pump.
PRODUCTION: 100,000 gpd, total for 10 wells.
TEMPERATURE: 57° F.

6, CONWAY BOROUGH, Conway. Drilled in 1939 by Layne-New York Co., Inc. USAGE: Municipal supply.

SURFACE ELEVATION: 707 feet. Top of casing 12 feet above surface.
DIAMETER OF CASING: 16 to 10 inches. 20 feet of screen at bottom.
DEPTH: 69.0 feet below land surface.

DRILLER'S LOG

	FEET
Fill	0—13
Clay	13—21
Brown sand and gravel	21—49
Gray sand and gravel	49—59
Blue sand and gravel	59—67
Clay	67—69

INSTALLATION: Turbine pump; capacity 300 gpm; motor, 40 hp.

PUMPING TEST

DATE: 1939. YIELD: 304 gpm.
STATIC LEVEL: 24 feet. SPECIFIC CAPACITY: 25.3 gpm/ft.
DRAWDOWN: 12 feet.

PRODUCTION: 110,000 gpd.
WATER LEVEL: 24.0 feet below land surface July 21, 1939.

7a, FREEDOM-VALVOLINE OIL CO., Freedom. Drilled in 1938 by James P. Leaf. USAGE: Cooling.

SURFACE ELEVATION: 700 feet.
DIAMETER OF CASING: 16 inches.
DEPTH: 60.7 feet below land surface.

CHEMICAL ANALYSIS

May 16, 1947

	PARTS PER MILLION *(except pH)*
Silica (SiO_2)	14
Iron (Fe)	0.1
Calcium (Ca)	36
Magnesium (Mg)	8
Carbonate (CO_3)	0
Bicarbonate (HCO_3)	81
Sulfate (SO_4)	75
Chloride (Cl)	27
Hardness (as $CaCO_3$)	123
Hydrogen-ion concentration (pH)	7.3

INSTALLATION: Centrifugal pump; capacity 500 gpm; motor, 40 hp.
PRODUCTION: 504,000 gpd, operating 24 hours/day.
TEMPERATURE: 65°F.
WATER LEVEL: 26 feet below land surface in 1938.

7b, FREEDOM-VALVOLINE OIL CO., Freedom. Drilled in 1938 by Gilkey Bros. USAGE: Cooling.

SURFACE ELEVATION: 700 feet.
DIAMETER OF CASING: 16 inches.
DEPTH: 66.6 feet below land surface.

CHEMICAL ANALYSIS

May 16, 1947

	PARTS PER MILLION *(except pH)*
Silica (SiO_2)	9
Iron (Fe)	0.7
Calcium (Ca)	32
Magnesium (Mg)	7
Carbonate (CO_3)	0
Bicarbonate (HCO_3)	92
Sulfate (SO_4)	50
Chloride (Cl)	14
Hardness (as $CaCO_3$)	109
Hydrogen-ion concentration (pH)	7.3

INSTALLATION: Centrifugal pump; capacity, 500 gpm; motor, 40 hp.
PRODUCTION: 360,000 gpd, operating 24 hours/day.
TEMPERATURE: 65° F.
WATER LEVEL: 26.0 feet below land surface in April 1938.

7c, FREEDOM-VALVOLINE OIL CO., Freedom. Drilled in 1940 by Guaranteed Water Corp. USAGE: Cooling.

SURFACE ELEVATION: 700 feet.
DIAMETER OF CASING: 18 inches.
DEPTH: 62.5 feet below land surface.

CHEMICAL ANALYSIS

May 16, 1947

	PARTS PER MILLION *(except pH)*
Silica (SiO_2)	6
Iron (Fe)	1.3
Calcium (Ca)	24
Magnesium (Mg)	8
Carbonate (CO_3)	0
Bicarbonate (HCO_3)	81
Sulfate (SO_4)	50
Chloride (Cl)	14
Hardness (as $CaCO_3$)	93
Hydrogen-ion concentration (pH)	7.3

INSTALLATION: Centrifugal pump; capacity, 1,000 gpm; motor, 75 hp.
PRODUCTION: 1,080,000 gpd, operating 24 hours/day.
TEMPERATURE: 65° F.
WATER LEVEL: 26 feet below land surface in 1940.

7d, FREEDOM-VALVOLINE OIL CO., Freedom. Drilled in 1942 by Gilkey Bros. USAGE: Cooling.

SURFACE ELEVATION: 700 feet.
DIAMETER OF CASING: 16 inches.
DEPTH: 64.0 feet below land surface.

DRILLER'S LOG

	FEET
Fill	0—10
Silt	10—30
Gravel	30—56
Fine "runny" sand	56—60
Sandstone	60—64

CHEMICAL ANALYSIS
May 16, 1947

	PARTS PER MILLION *(except pH)*
Silica (SiO_2)	7
Iron (Fe)	2.2
Calcium (Ca)	34
Magnesium (Mg)	7
Carbonate (CO_3)	0
Bicarbonate (HCO_3)	79
Sulfate (SO_4)	65
Chloride (Cl)	17
Hardness (as $CaCO_3$)	114
Hydrogen-ion concentration (pH)	7.0

INSTALLATION: Centrifugal pump; capacity, 750 gpm; motor, 40 hp.
PRODUCTION: 1,080,000 gpd, operating 24 hours/day.
TEMPERATURE: 65° F.
WATER LEVEL: 26 feet below land surface in 1942.

7e, FREEDOM-VALVOLINE OIL CO., Freedom. Drilled in 1943 by Freedom-Valvoline Oil Co. USAGE: Cooling.
SURFACE ELEVATION: 700 feet.
DIAMETER OF CASING: 16 inches.
DEPTH: 66.0 feet below land surface.

CHEMICAL ANALYSIS
May 16, 1947

	PARTS PER MILLION *(except pH)*
Silica (SiO_2)	9
Iron (Fe)	5.0
Calcium (Ca)	43
Magnesium (Mg)	10
Carbonate (CO_3)	0
Bicarbonate (HCO_3)	92
Sulfate (SO_4)	80
Chloride (Cl)	32
Hardness (as $CaCO_3$)	149
Hydrogen-ion concentration (pH)	7.2

INSTALLATION: Centrifugal pump; capacity, 500 gpm; motor, 40 hp.
PRODUCTION: 360,000 gpd, operating 12 hours/day.
TEMPERATURE: 54° F.
WATER LEVEL: 22.6 feet below land surface January 4, 1949.

7f, FREEDOM-VALVOLINE OIL CO., Freedom. Drilled in 1943 by Freedom-Valvoline Oil Co. USAGE: Cooling.
SURFACE ELEVATION: 700 feet.
DIAMETER OF CASING: 16 inches.
DEPTH: 68.0 feet below land surface.

CHEMICAL ANALYSIS
May 16, 1947

	PARTS PER MILLION *(except pH)*
Silica (SiO_2)	13
Iron (Fe)	0.9
Calcium (Ca)	40
Magnesium (Mg)	9
Carbonate (CO_3)	0
Bicarbonate (HCO_3)	81
Sulfate (SO_4)	50
Chloride (Cl)	103
Hardness (as $CaCO_3$)	137
Hydrogen-ion concentration (pH)	7.3

INSTALLATION: Centrifugal pump; capacity, 750 gpm; motor, 60 hp.
PRODUCTION: 1,080,000 gpd, operating at 24 hours/day.
TEMPERATURE: 52° F.
WATER LEVEL: 26 feet below land surface in 1943.

8a, BEAVER BOROUGH, Beaver. Ten wells drilled in 1923 by Al McCormick. USAGE: Municipal supply.

SURFACE ELEVATION: 680 feet. Top of casing below river surface.
DIAMETER OF CASING: 6 inches.
DEPTH: 40 feet below land surface.

CHEMICAL ANALYSIS

(Composite sample from wells 8a and 8b)

June 27, 1947

	PARTS PER MILLION *(except color and pH)*
Iron (Fe)	0.07
Calcium (Ca)	104
Magnesium (Mg)	25
Sulfate (SO_4)	104
Chloride (Cl)	84
Nitrate (NO_3)	4.8
Alkalinity (as $CaCO_3$, Phen.)	20
(as $CaCO_3$, MO)	203
Total solids	574
Total hardness (as $CaCO_3$)	362
Color	0
Ignition loss	131
Hydrogen-ion concentration (pH)	7.5
Turbidity	10

INSTALLATION: Plunger pump; capacity, 1,600 gpm.
PRODUCTION: Emergency use.
TEMPERATURE: 52° F.

8b, BEAVER BOROUGH, Beaver. Ten wells drilled in 1923 by Al McCormick. USAGE: Municipal supply.

SURFACE ELEVATION: 680 feet. Top of casing below river surface.
DIAMETER OF CASING: 6 inches.
DEPTH: 40 feet below land surface.

INSTALLATION: Plunger pump; capacity, 1,600 gpm.
PRODUCTION: 750,000 gpd, total for 10 wells.
TEMPERATURE: 52° F.

8c, BEAVER BOROUGH, Beaver. Drilled in 1947 by Gilkey Bros. USAGE: Municipal supply.

SURFACE ELEVATION: 692 feet. Top of casing at land surface.
DIAMETER OF CASING: 12 inches
DEPTH: 67.0 feet below land surface.

DRILLER'S LOG

	FEET
Sandy loam and large gravel	0— 9
Sandy clay	9—24
Fine sand	24—33
Sand and fine gravel	33—43
Sand and large gravel (water)	43—51
Sand, gravel, and clay	51—53
Sand and coarse gravel (water)	53—67

INSTALLATION: Pump not installed at present time.

PUMPING TEST

DATE: 1947.
DURATION: 8 hours.
STATIC LEVEL: 12 feet.
DRAWDOWN: 16.5 feet.
YIELD: 910 gpm.
SPECIFIC CAPACITY: 55.2 gpm/ft.

PRODUCTION: Not in use at present.
TEMPERATURE: 52° F.
WATER LEVEL: 12 feet below land surface in 1947.

8d, BEAVER BOROUGH, Beaver. Drilled in 1947 by Gilkey Bros. USAGE: Municipal supply.

SURFACE ELEVATION: 692 feet. Top of casing at land surface.
DIAMETER OF CASING: 12 inches
DEPTH: 61.0 feet below land surface.

DRILLER'S LOG

	FEET
Sandy loam	0— 3
Sandy clay	3—18
Fine sand	18—27
Sand and fine gravel	27—37
Sand and large gravel	37—43
Sand and coarse gravel	43—61

CHEMICAL ANALYSIS

June 27, 1947

	PARTS PER MILLION *(except color and pH)*
Iron (Fe)	0.07
Calcium (Ca)	100
Magnesium (Mg)	22
Sulfate (SO_4)	85
Chloride (Cl)	44
Nitrate (NO_3)	8.0
Alkalinity (as $CaCO_3$, Phen.)	19
(as $CaCO_3$, MO)	214
Total solids	501
Total hardness (as $CaCO_3$)	340
Color	0
Ignition loss	119
Hydrogen-ion concentration (pH)	7.3
Turbidity	0

INSTALLATION: Pump not installed at present time.

PUMPING TEST

DATE: 1947.
DURATION: 8 hours.
STATIC LEVEL: 12 feet.
DRAWDOWN: 15.7 feet
YIELD: 960 gpm.
SPECIFIC CAPACITY: 54.9 gpm/ft.

PRODUCTION: Not in use at present.
TEMPERATURE: 52° F.
WATER LEVEL: 12 feet below land surface in 1947.

8e, BEAVER BOROUGH, Beaver. Drilled in 1947 by Gilkey Bros. USAGE: Municipal supply.

SURFACE ELEVATION: 692 feet. Top of casing at land surface.
DIAMETER OF CASING: 12 inches.
DEPTH: 61.5 feet below land surface.

DRILLER'S LOG

	FEET
Sandy loam	0— 3
Sandy clay	3—18
Fine gravel and sand	18—41
Coarse gravel and sand	41—61.5

PUMPING TEST

DATE: 1947.
DURATION: 8 hours.
STATIC LEVEL: 12 feet.
DRAWDOWN: 19 feet.
YIELD: 960 gpm.
SPECIFIC CAPACITY: 50.5 gpm/ft.

PRODUCTION: Not in use at present.
TEMPERATURE: 52° F.
WATER LEVEL: 12 feet below land surface in 1947.

9a, BEAVER ICE CO., Beaver. Drilled in 1928 by Al McCormick. USAGE: Cooling.

SURFACE ELEVATION: 760 feet. Top of casing at land surface.
DIAMETER OF CASING: 10 inches.
DEPTH: 150 feet below land surface.

INSTALLATION: Plunger pump; capacity, 50 gpm.
PRODUCTION: 54,000 gpd, operating 18 hours/day.
TEMPERATURE: 55° F.
WATER LEVEL: 60 feet below land surface.

9b, BEAVER ICE CO., Beaver. Drilled in 1928 by Al McCormick. USAGE: Cooling.

SURFACE ELEVATION: 760 feet. Top of casing at land surface.
DIAMETER OF CASING: 10 inches.
DEPTH: 150 feet below land surface.

INSTALLATION: Plunger pump; capacity, 50 gpm.
PRODUCTION: 54,000 gpd, operating 18 hours/day.
TEMPERATURE: 55° F.
WATER LEVEL: 60 feet below land surface.

10a, BOROUGH TOWNSHIP MUNICIPAL AUTHORITY, Vanport. Drilled in 1941 by T. D. Gilkey & Sons. USAGE: Municipal supply.

SURFACE ELEVATION: 754.75 feet. Top of casing at land surface.
DIAMETER OF CASING: 12 inches.
DEPTH: 125.3 feet below land surface.

DRILLER'S LOG

	FEET
Sandy loam and clay	0— 6
Coarse gravel and sand	6— 66
Brown sand and gravel	66— 99
Sand and coarse gravel (water)	99—119
Sand and small fine gravel	119—122
Coarse gravel and sand	122—125.3

INSTALLATION: Turbine pump; capacity, 500 gpm.

PUMPING TEST

DATE: 1941.
DURATION: 24 hours.
STATIC LEVEL: 72 feet.
DRAWDOWN: 16 feet.
YIELD: 610 gpm.
SPECIFIC CAPACITY: 38.1 gpm/ft.

PRODUCTION: 270,000 gpd, total for wells 10a, 10b, and 10c operating 9 hours/day.
TEMPERATURE: 53° F.
WATER LEVEL: 72 feet below land surface in 1941.

10b, BOROUGH TOWNSHIP MUNICIPAL AUTHORITY, Vanport. Drilled in 1941 by T. D. Gilkey & Sons. USAGE: Municipal supply.

SURFACE ELEVATION: 754.75 feet. Top of casing at land surface.
DIAMETER OF CASING: 12 inches.
DEPTH: 117.3 feet below land surface.

DRILLER'S LOG

	FEET
Sandy loam and clay	0— 5
Coarse gravel and sand	5— 64
Brown sand and some fine gravel	64— 99
Sand and coarse gravel (water)	99—117.3

CHEMICAL ANALYSIS

(Composite sample from wells 10a, 10b, and 10c)

March 12, 1947

By E. C. GOEHRING

	PARTS PER MILLION *(except color and pH)*
Iron (Fe)	0.0
Manganese (Mn)	0.0
Chloride (Cl)	19
Alkalinity (as $CaCO_3$)	157
Hardness (as $CaCO_3$)	256
Color	0
Hydrogen-ion concentration (pH)	7.8
Turbidity	0

INSTALLATION: Turbine pump; capacity, 500 gpm.

PUMPING TEST

DATE: 1941.
DURATION: 24 hours.
STATIC LEVEL: 72 feet.
DRAWDOWN: 5 feet.
YIELD: 720 gpm.
SPECIFIC CAPACITY: 144 gpm/ft.

PRODUCTION: 270,000 gpd, total for wells 10a, 10b, and 10c operating 9 hours/day.
TEMPERATURE: 53° F.
WATER LEVEL: 72 feet below land surface in 1941.

10c, BOROUGH TOWNSHIP MUNICIPAL AUTHORITY, Vanport. Drilled in 1941 by T. D. Gilkey & Sons. USAGE: Municipal supply.

SURFACE ELEVATION: 754.75 feet. Top of casing at land surface.
DIAMETER OF CASING: 12 inches.
DEPTH: 116.5 feet below land surface.

DRILLER'S LOG

	FEET
Sandy loam and clay	0— 4
Coarse gravel and sand	4— 64
Brown sand and some gravel	64—101
Sand and fine gravel (water)	101—107
Coarse gravel and a little sand	107—110
Fine sand and gravel	110—116.5

INSTALLATION: Turbine pump; capacity, 500 gpm.

PUMPING TEST

DATE: 1941.
DURATION: 16 hours.
STATIC LEVEL: 72 feet.
DRAWDOWN: 12 feet.
YIELD: 640 gpm.
SPECIFIC CAPACITY: 53.3 gpm/ft.

PRODUCTION: 270,000 gpd, total for wells 10a, 10b, and 10c operating 9 hours/day.
TEMPERATURE: 53° F.
WATER LEVEL: 72 feet below land surface in 1941.

11a, MONONGAHELA LAND CO. (Ohioview Water System), Industry Township. Drilled in 1929. USAGE: Municipal supply.

SURFACE ELEVATION: 750 feet. Top of casing at land surface.
DIAMETER OF CASING: 4 inches.
DEPTH: 165.6 feet below land surface.
AQUIFER: Allegheny group

INSTALLATION: Plunger pump; capacity, 15 gpm.
PRODUCTION: Emergency use.
TEMPERATURE: 53° F.
WATER LEVEL: 90 feet below land surface

11b, MONONGAHELA LAND CO. (Ohioview Water System), Industry Township. Drilled in 1943 by J. C. Boyd. USAGE: Municipal supply.

SURFACE ELEVATION: 750 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 inches.
DEPTH: 128 feet below land surface.

CHEMICAL ANALYSIS

July 9, 1943

	PARTS PER MILLION *(except pH)*
Iron (Fe)	0.15
Alkalinity (as $CaCO_3$)	214
Hardness (as $CaCO_3$)	326
Hydrogen-ion concentration (pH)	7.8

INSTALLATION: Turbine pump; capacity, 150 gpm.
PRODUCTION: 18,000 gpd, operating 2 hours/day.
TEMPERATURE: 53° F.
WATER LEVEL: 90 feet below land surface

12, TREADWELL CONSTRUCTION CO., foot of 12th St., Midland. Drilled in 1941 by Gilkey Bros. USAGE: Cooling, drinking.

SURFACE ELEVATION: 698 feet. Top of casing.
DIAMETER OF CASING: 10 inches.
DEPTH: 60.0 feet below land surface.

CHEMICAL ANALYSIS

October 10, 1941

By The Permutit Co.

	PARTS PER MILLION *(except color and pH)*
Iron (Fe)	0.1
Sulfite (SO_3)	54
Chloride (Cl)	49
Alkalinity (as $CaCO_3$, Phen.)	0
(as $CaCO_3$, MO)	232
Free CO_2	17
Hardness (as $CaCO_3$)	334
Color	5
Hydrogen-ion concentration (pH)	7.4

INSTALLATION: Turbine pump; capacity, 150 gpm; motor, 15 hp.

PUMPING TEST

DATE: 1941.
DURATION: 24 hours.
DRAWDOWN: 5 feet.
YIELD: 195 gpm.
SPECIFIC CAPACITY: 39 gpm/ft.

PRODUCTION: 75,000 gpd, operating 10 hours/day.
TEMPERATURE: 53° F.
WATER LEVEL: 35.0 feet below land surface in December 1948.

13a, MACKINTOSH-HEMPHILL CO., 12th St., Midland. Drilled in 1941 by Gilkey Bros. USAGE: Cooling.

SURFACE ELEVATION: 775 feet.
DIAMETER OF CASING: 10 inches.
DEPTH: 62.0 feet below land surface.

INSTALLATION: Plunger pump.
PRODUCTION: Pumped at 20 gpm, abandoned in October 1948.
TEMPERATURE: 53° F.
WATER LEVEL: 45 feet below land surface in 1948.

13b, MACKINTOSH-HEMPHILL CO., 12th St., Midland. Drilled in 1941 by Gilkey Bros. USAGE: Cooling.

SURFACE ELEVATION: 775 feet.
DIAMETER OF CASING: 10 inches.
DEPTH: 62.0 feet below land surface.

INSTALLATION: Plunger pump.
PRODUCTION: Pumped at 20 gpm, abandoned in October 1948.
TEMPERATURE: 53° F.
WATER LEVEL: 45 feet below land surface in 1948.

14, MIDLAND SLAG CO., Midland. Drilled in 1945 by Arthur Evans. USAGE: Wetting slag pit.

SURFACE ELEVATION: 750 feet.
DIAMETER OF CASING: 10 inches.
DEPTH: 126 feet below land surface.

INSTALLATION: Turbine pump; capacity, 150 gpm.
PRODUCTION: 72,000 gpd, operating 8 hours/day.
WATER LEVEL: 60 feet below land surface.

15a, KOPPERS CO., INC., Potter Township. Drilled in 1942 by Ohio Drilling Co. USAGE: Drinking, fire protection.

SURFACE ELEVATION: 753.7 feet. Top of casing at land surface.
DIAMETER OF CASING: 16 inches.
DEPTH: 113.7 feet below land surface.

DRILLER'S LOG

	FEET
Loam	0— 1
Sand, gravel, and clay	1— 22
Clay and gravel, some sand	22— 25
Sand and gravel	25— 41
Hardpan	41— 47
Sand and gravel	47— 66
Sand, some gravel (compact)	66— 82
Sand, gravel, and some clay	82—100
Coarse sand and fine gravel	100—110
Clay and gravel, some sand	110—112
Sand and gravel	112—130

INSTALLATION: Turbine pump; capacity, 500 gpm; motor, 40 hp.
PRODUCTION: Emergency use only.
TEMPERATURE: 60° F.
WATER LEVEL: 73.0 feet below land surface in 1942.

15b, KOPPERS CO., INC., Potter Township. Drilled in 1942 by Ohio Drilling Co. USAGE: Not in use.

SURFACE ELEVATION: 759.2 feet. Top of casing 0.5 foot above land surface.
DIAMETER OF CASING: 16 inches.
DEPTH: 121.0 feet below land surface.

DRILLER'S LOG

	FEET
Sand, gravel, and a little clay	0— 9
Compact sand and gravel	9— 75
Sand and gravel	75— 97
Sand and a little gravel	97—100
Fine sand	100—108
Sand and gravel	108—117
Sand, gravel, and a little clay	117—120

INSTALLATION: No pump.

PUMPING TEST

DATE: 1942.
DURATION: 78 hours.
STATIC LEVEL: 76.5 feet.
DRAWDOWN: 4 feet.
YIELD: 835 gpm.
SPECIFIC CAPACITY: 208.8 gpm/ft.

PRODUCTION: None, well abandoned.
TEMPERATURE: 58° F.
WATER LEVEL: 76.5 feet below land surface on October 22, 1942.

15c, KOPPERS CO., INC., Potter Township. Drilled in 1942 by Ohio Drilling Co. USAGE: Not in use.

SURFACE ELEVATION: 752.7 feet. Top of casing 2.3 feet above land surface.
DIAMETER OF CASING: 16 inches.
DEPTH: 111.25 feet below land surface.

DRILLER'S LOG

	FEET
Clay and boulders	0— 8
Compact sand and gravel	8— 65
Loose sand and gravel	65— 77
Sand	77— 80
Sand and small gravel	80— 90
Medium sand	90— 95
Coarse sand	95—100
Sand and small gravel	100—105
Medium sand	105—108
Silty sand and gravel	108—112

INSTALLATION: No pump.

PUMPING TEST

DATE: 1942.
DURATION: 55 hours.
STATIC LEVEL: 67 feet.
DRAWDOWN: 2.5 feet.
YIELD: 800 gpm.
SPECIFIC CAPACITY: 320 gpm/ft.

PRODUCTION: None, well abandoned.
TEMPERATURE: 59° F.
WATER LEVEL: 67.0 feet below land surface on December 16, 1942.

15d, KOPPERS CO., INC., Potter Township. Drilled in 1943 by Pennsylvania Drilling Co. USAGE: Drinking, fire protection.

SURFACE ELEVATION: 740 feet. Top of casing at land surface.
DIAMETER OF CASING: 12 inches.
DEPTH: 100 feet below land surface.

INSTALLATION: Turbine pump; capacity, 500 gpm; motor, 40 hp.
PRODUCTION: 720,000 gpd, operating 24 hours/day.
TEMPERATURE: 60° F.
WATER LEVEL: 60 feet below land surface in 1943.

15e, KOPPERS CO., INC., Potter Township. Drilled in 1944 by Ohio Drilling Co. USAGE: Not in use.

SURFACE ELEVATION: 740 feet. Top of casing at land surface.
DIAMETER OF CASING: 16 to 12 inches. 20 feet of screen 78-98 feet.
DEPTH: 107.0 feet below land surface.

DRILLER'S LOG

	FEET
Clay and sand	0— 30
Clay, gravel, and sand	30— 73
Sand and gravel	73— 81
Clay and gravel	81— 88
Gravel	88— 90
Medium sand	90— 97
Clay and gravel	97— 99
Gravel and clay	99—105
Clay and shale	105—107

INSTALLATION: Turbine pump; capacity, 500 gpm; motor, 40 hp.

PUMPING TEST

DATE: 1944.
DURATION: 48 hours.
STATIC LEVEL: 58 feet.
DRAWDOWN: 27 feet.
YIELD: 410 gpm.
SPECIFIC CAPACITY: 15.2 gpm/ft.

PRODUCTION: Not in use.
TEMPERATURE: 60° F.
WATER LEVEL: 58.0 feet below land surface on August 9, 1944.

16a, BEAVER COUNTY HOME, Potter Township. Drilled about 1920. USAGE: Drinking, general.

SURFACE ELEVATION: 760 feet. Top of casing at land surface.
DIAMETER OF CASING: 6 inches.
DEPTH: 165 feet below land surface.

INSTALLATION: Plunger pump; capacity, 50 gpm.
PRODUCTION: 30,000 gpd, total for wells 16a and 16b operating 10 hours/day.
TEMPERATURE: 55° F.
WATER LEVEL: 70 feet below land surface.

16b, BEAVER COUNTY HOME, Potter Township. Drilled in 1931 by Tom Gilkey. USAGE: Drinking, general.

SURFACE ELEVATION: 760 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 to 6 inches. 10 feet of screen at bottom.
DEPTH: 140 feet below land surface.

INSTALLATION: Plunger pump; capacity, 50 gpm.
PRODUCTION: 30,000 gpd, total for wells 16a and 16b operating 10 hours/day.
TEMPERATURE: 55° F.
WATER LEVEL: 70 feet below land surface.

17a, ST. JOSEPH LEAD CO., Potter Township. Twelve wells drilled in 1930. USAGE: General plant use.

SURFACE ELEVATION: 672 feet. Top of casings below river surface.
DIAMETER OF CASING: 12 inches.
DEPTH: 30.0 feet below land surface.

INSTALLATION: 4 centrifugal pumps, capacities 450, 1,500, 1,500, 2,500 gpm.
PRODUCTION: 5,040,000 gpd, total for 23 wells, 17a and 17b, pumped as a unit.
TEMPERATURE: 57° F.

17b, ST. JOSEPH LEAD CO., Potter Township. Eleven wells drilled in 1941 by Gilkey Bros. USAGE: General plant use.

SURFACE ELEVATION: 677.25 to 680.5 feet. Top of casings below river surface.
DIAMETER OF CASING: 12 inches.
DEPTH: 52.0 feet below land surface.

CHEMICAL ANALYSIS
(Composite sample for wells 17a and 17b)

	PARTS PER MILLION (except pH)
Alkalinity (as $CaCO_3$, MO)	110
(as $CaCO_3$, Phen.)	0
(as $CaCO_3$, MR)	102
Hydrogen-ion concentration (pH)	7.3

INSTALLATION: 4 centrifugal pumps, capacities 450, 1,500, 1,500, 2,500 gpm.
PRODUCTION: 5,040,000 gpd, total for 23 wells, 17a and 17b, pumped as a unit.

17c, ST. JOSEPH LEAD CO., Potter Township. Drilled in 1947 by Gilkey Bros. USAGE: General plant use.

SURFACE ELEVATION: 788 feet. Top of casing at land surface.
DIAMETER OF CASING: 12 inches. 14 feet of screen at bottom.
DEPTH: 152.0 feet below land surface.

CHEMICAL ANALYSIS
(Composite sample for wells 17c and 17d)

	PARTS PER MILLION (except pH)
Alkalinity (as $CaCO_3$, MO)	92
(as $CaCO_3$, Phen.)	0
(as $CaCO_3$, MR)	88
Hydrogen-ion concentration (pH)	7.8

INSTALLATION: Centrifugal pump; capacity, 1,000 gpm; motor, 100 hp.

PUMPING TEST

DATE: 1947.
DURATION: 8 hours.
STATIC LEVEL: 107 feet.
DRAWDOWN: 22 feet.
YIELD: 1,380 gpm.
SPECIFIC CAPACITY: 62.7 gpm/ft.

PRODUCTION: 1,440,000 gpd, operating 24 hours/day.
TEMPERATURE: 56° F.
WATER LEVEL: 107.0 feet below land surface on February 11, 1947.

17d, ST. JOSEPH LEAD CO., Potter Township. Drilled in 1947 by Gilkey Bros. USAGE: General plant use.

SURFACE ELEVATION: 788 feet. Top of casing at land surface.
DIAMETER OF CASING: 13 inches. 15 feet of screen at bottom.
DEPTH: 153.0 feet below land surface.

INSTALLATION: Centrifugal pump; capacity, 1,000 gpm; motor, 100 hp.
PRODUCTION: 1,440,000 gpd, operating 24 hours/day.
TEMPERATURE: 56° F.
WATER LEVEL: 107.0 feet below land surface on February 11, 1947.

18a, MONACA BOROUGH, Monaca. Drilled before 1930. USAGE: Municipal supply.

SURFACE ELEVATION: 680 feet.
DIAMETER OF CASING: 10 inches.
DEPTH: 45 feet below land surface.

INSTALLATION: 2 centrifugal pumps; capacity, 850 gpm each; motors, 25 hp.
PRODUCTION: 580,000 gpd, total for wells 18a to 18j, operating as a unit.
TEMPERATURE: 57° F.
WATER LEVEL: 5 feet below land surface.

18b, MONACA BOROUGH, Monaca. Drilled before 1930. USAGE: Municipal supply.

SURFACE ELEVATION: 680 feet.
DIAMETER OF CASING: 10 inches.
DEPTH: 45 feet below land surface.

INSTALLATION: 2 centrifugal pumps; capacity, 850 gpm each; motors, 25 hp.
PRODUCTION: 580,000 gpd, total for wells 18a to 18j, operating as a unit.
TEMPERATURE: 57° F.
WATER LEVEL: 5 feet below land surface.

18c, MONACA BOROUGH, Monaca. Drilled in 1933 by T. D. Gilkey. USAGE: Municipal supply.

SURFACE ELEVATION: 680 feet. Top of casing at land surface.
DIAMETER OF CASING: 10 inches. Casing perforated at bottom.
DEPTH: 47.0 feet below land surface.

DRILLER'S LOG

	FEET
Sand	0—20
Wood chips	20—22
Sand	22—30
Fine gravel and little clay	30—47

CHEMICAL ANALYSIS
(Composite sample from all Monaca wells)
Nov. 22, 1944

	PARTS PER MILLION *(except color and pH)*
Iron (Fe)	0.07
Manganese (Mn)	.0
Magnesium (Mg)	36
Chloride (Cl)	50
Nitrate (NO_3)	3.5
Alkalinity (as $CaCO_3$, Phen.)	180
Free CO_2	11
Hardness (as $CaCO_3$)	320
Color	3
Hydrogen-ion concentration (pH)	7.15
Total residue	606
Volatile matter	52

NOTE: Sample taken after chlorination.

INSTALLATION: 2 centrifugal pumps; capacity, 850 gpm each; motor, 25 hp.

PUMPING TEST

DATE: 1933.
DURATION: 24 hours.
STATIC LEVEL: 5 feet.
DRAWDOWN: 18 feet.
YIELD: 105 gpm.
SPECIFIC CAPACITY: 5.8 gpm/ft.

PRODUCTION: 580,000 gpd, total for wells 18a to 18j, operating as a unit.
TEMPERATURE: 57° F.
WATER LEVEL: 5 feet below land surface.

18d, MONACA BOROUGH, Monaca. Drilled in 1933 by T. D. Gilkey. USAGE: Municipal supply.

SURFACE ELEVATION: 680 feet. Top of casing at land surface.
DIAMETER OF CASING: 10 inches. Casing perforated at bottom.
DEPTH: 45 feet below land surface.

INSTALLATION: 2 centrifugal pumps; capacity, 850 gpm each; motor, 25 hp.

PUMPING TEST

DATE: 1933.
DURATION: 24 hours.
STATIC LEVEL: 5 feet.
DRAWDOWN: 8.4 feet.
YIELD: 250 gpm.
SPECIFIC CAPACITY: 29.8 gpm/ft.

PRODUCTION: 580,000 gpd, total for wells 18a to 18j, operating as a unit.
TEMPERATURE: 57° F.
WATER LEVEL: 5 feet below land surface.

18e, MONACA BOROUGH, Monaca. Drilled in 1933 by T. D. Gilkey. USAGE: Municipal supply.

SURFACE ELEVATION: 680 feet. Top of casing at land surface.
DIAMETER OF CASING: 10 inches. Casing perforated at bottom.
DEPTH: 49.0 feet below land surface.

DRILLER'S LOG

	FEET
Sand	0—21
Wood chips	21—22
Sand	22—32
Sand and gravel	32—49

INSTALLATION: 2 centrifugal pumps; capacity, 850 gpm each; motor, 25 hp.

PUMPING TEST

DATE: 1933.
DURATION: 24 hours.
STATIC LEVEL: 5 feet.
DRAWDOWN: 6.5 feet.
YIELD: 225 gpm.
SPECIFIC CAPACITY: 34.6 gpm/ft.

PRODUCTION: 580,000 gpd, total for wells 18a to 18j, operating as a unit.
TEMPERATURE: 57° F.
WATER LEVEL: 5 feet below land surface.

18f, MONACA BOROUGH, Monaca. Drilled in 1933, by T. D. Gilkey. USAGE: Municipal supply.

SURFACE ELEVATION: 680 feet. Top of casing at land surface.
DIAMETER OF CASING: 10 inches. Casing perforated at bottom.
DEPTH: 50.0 feet below land surface.

DRILLER'S LOG

	FEET
Sand	0—22
Sand and a little gravel	22—34
Sand and gravel	34—50
Bedrock	50—

INSTALLATION: 2 centrifugal pumps; capacity, 850 gpm each; motor, 25 hp.

PUMPING TEST

DATE: 1933.
DURATION: 24 hours.
STATIC LEVEL: 5 feet.
DRAWDOWN: 4 feet.
YIELD: 175 gpm.
SPECIFIC CAPACITY: 43.8 gpm/ft.

PRODUCTION: 580,000 gpd, total for wells 18a to 18j, operating as a unit.
TEMPERATURE: 57° F.
WATER LEVEL: 5 feet below land surface.

18g, MONACA BOROUGH, Monaca. Drilled in 1933 by T. D. Gilkey. USAGE: Municipal supply.

SURFACE ELEVATION: 680 feet. Top of casing at land surface.
DIAMETER OF CASING: 10 inches. Casing perforated at bottom.
DEPTH: 45 feet below land surface.

INSTALLATION: 2 centrifugal pumps; capacity, 850 gpm each; motor, 25 hp.

PUMPING TEST

DATE: 1933.
DURATION: 24 hours.
STATIC LEVEL: 5 feet.
DRAWDOWN: 14 feet.
YIELD: 200 gpm.
SPECIFIC CAPACITY: 14.3 gpm/ft.

PRODUCTION: 580,000 gpd, total for wells 18a to 18j, operating as a unit.
TEMPERATURE: 57° F.
WATER LEVEL: 5 feet below land surface.

18h, MONACA BOROUGH, Monaca. Drilled in 1933 by T. D. Gilkey. USAGE: Municipal supply.

SURFACE ELEVATION: 680 feet. Top of casing at land surface.
DIAMETER OF CASING: 10 inches. Casing perforated at bottom.
DEPTH: 45.0 feet below land surface.

DRILLER'S LOG

	FEET
Sand	0— 5
Cobblestones	5—10
Sand and gravel	10—35
Fine packed gravel	35—45

INSTALLATION: 2 centrifugal pumps; capacity, 850 gpm each; motor, 25 hp.

PUMPING TEST

DATE: 1933.
DURATION: 24 hours.
STATIC LEVEL: 5 feet.
DRAWDOWN: 8 feet
YIELD: 150 gpm.
SPECIFIC CAPACITY: 18.8 gpm/ft.

PRODUCTION: 580,000 gpd, total for wells 18a to 18j, operating as a unit.
TEMPERATURE: 57° F.
WATER LEVEL: 5 feet below land surface.

18i, MONACA BOROUGH, Monaca. Drilled in 1933 by T. D. Gilkey. USAGE: Municipal supply.

SURFACE ELEVATION: 680 feet. Top of casing at land surface.
DIAMETER OF CASING: 10 inches. Casing perforated at bottom.
DEPTH: 46.0 feet below land surface.

DRILLER'S LOG

	FEET
Sand	0—25
Sand and a little gravel	25—30
Fine gravel and sand	30—40
Fine packed gravel	40—46

INSTALLATION: 2 centrifugal pumps; capacity, 850 gpm each; motor, 25 hp.

PUMPING TEST

DATE: 1933.
DURATION: 24 hours.
STATIC LEVEL: 5 feet.
DRAWDOWN: 9.4 feet.
YIELD: 135 gpm.
SPECIFIC CAPACITY: 14.4 gpm/ft.

PRODUCTION: 580,000 gpd, total for wells 18a to 18j, operating as a unit.
TEMPERATURE: 57° F.
WATER LEVEL: 5 feet below land surface.

18j, MONACA BOROUGH, Monaca. Drilled in 1933 by T. D. Gilkey. USAGE: Municipal.

SURFACE ELEVATION: 680 feet. Top of casing at land surface.
DIAMETER OF CASING: 10 inches. Casing perforated at bottom.
DEPTH: 43.0 feet below land surface.

DRILLER'S LOG

	FEET
Boulders	0—15
Sand and a little gravel	15—23
Fine gravel and sand	23—40
Coarse packed gravel	40—43

INSTALLATION: 2 centrifugal pumps; capacity, 850 gpm each; motor, 25 hp.

PUMPING TEST

DATE: 1933.
DURATION: 24 hours.
STATIC LEVEL: 5 feet.
DRAWDOWN: 7.75.
YIELD: 142 gpm.
SPECIFIC CAPACITY: 18.3 gpm/ft.

PRODUCTION: 580,000 gpd, total for wells 18a to 18j, operating as a unit.
TEMPERATURE: 57° F.
WATER LEVEL: 5 feet below land surface.

19, PHOENIX GLASS CO., Washington Ave. and 9th St., Monaca. Drilled about 1910. USAGE: Drinking, general.

SURFACE ELEVATION: 740 feet. Top of casing at land surface.
DIAMETER OF CASING: 12 inches.
DEPTH: 103.0 feet below land surface.

INSTALLATION: Turbine pump; capacity, 200 gpm; motor, 15 hp.

PUMPING TEST

DATE: 1947.
DURATION: 12 hours.
STATIC LEVEL: 32 feet.
DRAWDOWN: 26 feet.
YIELD: 200 gpm.
SPECIFIC CAPACITY: 7.7 gpm/ft.

PRODUCTION: 240,000 gpd, operating 20 hours/day.
TEMPERATURE: 54° F.
WATER LEVEL: 32.0 feet below land surface in August 1947.

20, RICHMOND RADIATOR CO., 1729 Penn Ave., Monaca. Drilled in 1920 by Mr. Flocker. USAGE: Washing, drinking, fire protection.

SURFACE ELEVATION: 730 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 inches.
DEPTH: 94 feet below land surface.

INSTALLATION: Turbine pump; capacity, 125 gpm; motor, 10 hp.

PUMPING TEST

DATE: 1938.
DURATION: 36 hours.
STATIC LEVEL: 57 feet.
DRAWDOWN: 7 feet.
YIELD: 125 gpm.
SPECIFIC CAPACITY: 17.9 gpm/ft.

PRODUCTION: 120,000 gpd, operating 16 hours/day.
TEMPERATURE: 58° F.
WATER LEVEL: 57.0 feet below land surface on December 5, 1938.

21, PITTSBURGH TUBE CO., Penn Ave., Monaca. Drilled in 1942 by Ohio Drilling Co. USAGE: Cooling.

SURFACE ELEVATION: 740 feet. Top of casing at land surface.
DIAMETER OF CASING: 16 inches. 15 feet of bronze screen.
DEPTH: 105.0 feet below land surface.

DRILLER'S LOG

	FEET
Sand and clay	0 — 27
Sand, gravel, and a little clay	27 — 43
Sand, gravel, and clay	43 — 78
Gravel, sand, and a little clay	78 — 83.5
Sand, gravel, and clay	83.5— 92.5
Sand, gravel, and a little clay	92.5—106.5
Sand, gravel, and clay	106.5—108
Clay	108 —109
Shale	109 —109 +

INSTALLATION: Turbine pump; capacity, 500 gpm; motor, 25 hp.

PUMPING TEST

DATE: 1942.
DURATION: 24 hours.
STATIC LEVEL: 60 feet.
DRAWDOWN: 7.5 feet.
YIELD: 575 gpm.
SPECIFIC CAPACITY: 76.7 gpm/ft.

PRODUCTION: 720,000 gpd, operating 24 hours/day.
TEMPERATURE: 55° F.
WATER LEVEL: 60.0 feet below land surface in 1942.

22, PITTSBURGH & LAKE ERIE RAILROAD, Monaca. Drilled in 1932 by Pittsburgh & Lake Erie Railroad. USAGE: Drinking.

SURFACE ELEVATION: 702 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 inches. 10 feet perforated at bottom.
DEPTH: 76.0 feet below land surface.

DRILLER'S LOG

	FEET
Fill	0— 7
Sandy loam	7—14
Sandy clay	14—36
Sand and gravel	36—70
Shale	70—76

CHEMICAL ANALYSIS

Aug. 29, 1946

	PARTS PER MILLION
Iron (Fe)	0.0
Chloride (Cl)	44.7
Alkalinity (as $CaCO_3$, MO)	148
Free CO_2	17.2
Hardness (as $CaCO_3$)	344

INSTALLATION: Turbine pump.
PRODUCTION: 27,000 gpd, operating 3 hours/day.
TEMPERATURE: 63° F.
WATER LEVEL: 25.5 feet below land surface on November 19, 1932.

23a, VANADIUM-ALLOYS STEEL CO. (Colonial Steel Division), Monaca. Drilled in 1921. USAGE: Drinking.

SURFACE ELEVATION: 754 feet. Top of casing at land surface.
DIAMETER OF CASING: 8⅝ to 5⅝ inches.
DEPTH: 105.0 feet below land surface.

CHEMICAL ANALYSIS

Apr. 5, 1922

	PARTS PER MILLION
Silica (SiO_2)	1.3
Iron (Fe) and Aluminum (Al)	87
Calcium oxide (CaO)	16
Magnesium oxide (MgO)	11
Sodium oxide (NaO)	11.6
Sulfite (SO_3)	92
Chloride (Cl)	34

INSTALLATION: Plunger pump.
PRODUCTION: 10,000 gpd, operating 12 hours/day.
TEMPERATURE: 55° F.
WATER LEVEL: 78 feet below land surface.

23b, VANADIUM-ALLOYS STEEL CO. (Colonial Steel Division), Monaca. Drilled about 1900. USAGE: Drinking.

SURFACE ELEVATION: 755 feet. Top of casing at land surface.
DEPTH: 100 feet below land surface.

INSTALLATION: Plunger pump.
PRODUCTION: 8,400 gpd, operating 10 hours/day.
TEMPERATURE: 55° F.
WATER LEVEL: 78 feet below land surface.

24, VULCAN CRUCIBLE STEEL CO., Aliquippa. USAGE: Drinking.

SURFACE ELEVATION: 740 feet. Top of casing at land surface.
DIAMETER OF CASING: 6 inches.
DEPTH: 93 feet below land surface.

INSTALLATION: Manual pump.
PRODUCTION: None, well abandoned.
TEMPERATURE: 53° F.
WATER LEVEL: 59.25 feet below land surface on November 1, 1944.

25a, WEST ALIQUIPPA BOROUGH, Aliquippa. Drilled in 1945 by Ohio Drilling Co. USAGE: Municipal supply.

SURFACE ELEVATION: 741 feet. Top of casing at land surface.
DIAMETER OF CASING: 30 to 16 inches: 15-foot bronze screen at bottom.
DEPTH: 98 feet below land surface.

DRILLER'S LOG

	FEET
Clay	0—35
Sand and clay	35—40
Sand	40—45
Black sand	45—55
Clay and stone	55—75
Sand, gravel, and clay	75—85
Sand and gravel	85—98

CHEMICAL ANALYSIS
(Composite sample from wells 25a and 25b)
Dec. 7, 1945

	PARTS PER MILLION *(except pH)*
Chloride (Cl)	65
Alkalinity (as $CaCO_3$, Phen.)	62
(as $CaCO_3$, MO)	224
Hardness (as $CaCO_3$)	456
Hydrogen-ion concentration (pH)	7.15

NOTE: Sample taken after chlorination.

INSTALLATION: Turbine pump; capacity, 400 gpm; motor, 50 hp.

PUMPING TEST

DATE: 1945.
DURATION: 24 hours.
STATIC LEVEL: 60 feet.
DRAWDOWN: 15 feet.
YIELD: 820 gpm.
SPECIFIC CAPACITY: 54.7 gpm/ft.

PRODUCTION: 260,000 gpd.
TEMPERATURE: 53° F.
WATER LEVEL: 60 feet below land surface in July 1945.

25b, WEST ALIQUIPPA BOROUGH, Aliquippa. Drilled in 1945 by Ohio Drilling Co.
USAGE: Municipal supply.

SURFACE ELEVATION: 745 feet. Top of casing at land surface.
DIAMETER OF CASING: 30 to 16 inches. 15 foot bronze screen at bottom.
DEPTH: 102 feet below land surface.

DRILLER'S LOG

	FEET
Clay, sand, and gravel	0— 40
Sand, gravel and a little clay	40— 65
Sand and gravel	65— 85
Sand and a little gravel	85— 90
Sand and gravel	90—100
Clay and gravel	100—101
Sandrock and coal	101—102

INSTALLATION: Turbine pump; capacity, 400 gpm; motor, 50 hp.

PUMPING TEST

DATE: 1945.
DURATION: 24 hours.
STATIC LEVEL: 58 feet.
DRAWDOWN: 24 feet.
YIELD: 860 gpm.
SPECIFIC CAPACITY: 35.8 gpm/ft.

PRODUCTION: Alternate well operating at 400 gpm.
TEMPERATURE: 53° F.
WATER LEVEL: 63 feet below land surface January 1949.

26a, WOODLAWN WATER CO., Aliquippa. Drilled in 1939 by Ohio Drilling Co.
USAGE: Municipal supply.

SURFACE ELEVATION: 727.5 feet. Top of casing at land surface.
DIAMETER OF CASING: 16 inches. 20 feet of screen at bottom.
DEPTH: 85.0 feet below land surface.

DRILLER'S LOG

	FEET
Ashes and slag	0 —27
Yellow clay	27 —43.5
Blue clay	43.5—48.5
Blue clay, shale, and sand	48.5—54
Yellow clay, stones, and sand	54 —57
Sand, clay, and gravel	57 —63
Gravel and coarse sand	63 —67
Gravel, coarse sand, and a little clay	67 —72
Clay, gravel, and sand	72 —85
Shale	85 —85 +

CHEMICAL ANALYSIS

Apr. 16, 1940

By MORRIS KNOWLES, INC.

	PARTS PER MILLION *(except color and pH)*
Iron (Fe)	0.05
Manganese (Mn)	0.08
Chloride (Cl)	29
Alkalinity (as $CaCO_3$, Phen.)	6.0
(as $CaCO_3$, MO)	118
Hardness (as $CaCO_3$)	233
Color	0
Turbidity	0
Hydrogen-ion concentration (pH)	7.6

INSTALLATION: Turbine pump; capacity, 500 gpm; motor, 25 hp.

PUMPING TEST

DATE: 1939.
DURATION: 24 hours.
STATIC LEVEL: 44 feet.
DRAWDOWN: 14 feet.
YIELD: 575 gpm.
SPECIFIC CAPACITY: 41.1 gpm/ft.

PRODUCTION: 2,570,000 gpd, total for wells 26a to 26f.
TEMPERATURE: 60° F.
WATER LEVEL: 44.0 feet below land surface April 20, 1939.

26b, WOODLAWN WATER CO., Aliquippa. Drilled in 1939 by Ohio Drilling Co. USAGE: Municipal supply.

SURFACE ELEVATION: 731.0 feet. Top of casing at land surface.
DIAMETER OF CASING: 16 inches. 20 feet of screen at bottom.
DEPTH: 87.0 feet below land surface.

DRILLER'S LOG

	FEET
Slag fill	0—32
Clay and ashes	32—35
Black muck	35—40
Yellow clay	40—53
Blue clay with sand layers	53—58
Blue clay, shale, and sand rock	58—61
Yellow clay, gravel, and sand	61—66
Gravel, sand, and clay	66—87

CHEMICAL ANALYSIS

Apr. 16, 1940

By MORRIS KNOWLES, INC.

	PARTS PER MILLION *(except color and pH)*
Iron (Fe)	0.10
Manganese (Mn)	0.12
Chloride (Cl)	30
Alkalinity (as $CaCO_3$, Phen.)	4.0
(as $CaCO_3$, MO)	98
Hardness (as $CaCO_3$)	214
Color	0
Turbidity	0
Hydrogen-ion concentration (pH)	7.3

INSTALLATION: Turbine pump; capacity, 500 gpm; motor, 25 hp.

PUMPING TEST

DATE: 1939.
DURATION: 24 hours.
STATIC LEVEL: 48 feet.
DRAWDOWN: 14 feet.
YIELD: 615 gpm.
SPECIFIC CAPACITY: 43.9 gpm/ft.

PRODUCTION: 2,570,000 gpd, total for wells 26a to 26f.
TEMPERATURE: 60° F.
WATER LEVEL: 48 feet below land surface in 1949.

26c, WOODLAWN WATER CO., Aliquippa. Drilled in 1939 by Ohio Drilling Co. USAGE: Municipal supply.

SURFACE ELEVATION: 732.0 feet. Top of casing at land surface.
DIAMETER OF CASING: 24 to 16 inches. 20 feet of screen at bottom.
DEPTH: 88.0 feet below land surface.

DRILLER'S LOG

	FEET
Fill	0—43
Clay, sand, and coal	43—48
Clay and sand	48—58
Sandrock, clay, and stones	58—63
Gravel, sand, and clay	63—88
Shale	88—88 +

CHEMICAL ANALYSIS

Apr. 16, 1940

By MORRIS KNOWLES, INC.

	PARTS PER MILLION *(except color and pH)*
Iron (Fe)	0.60
Manganese (Mn)	0.85
Chloride (Cl)	27
Alkalinity (as $CaCO_3$, Phen.)	5.0
(as $CaCO_3$, MO)	108
Hardness (as $CaCO_3$)	242
Color	0
Turbidity	slight
Hydrogen-ion concentration (pH)	7.4

INSTALLATION: Turbine pump; capacity, 500 gpm; motor, 25 hp.

PUMPING TEST

DATE: 1939.
DURATION: 24 hours.
STATIC LEVEL: 50 feet.
DRAWDOWN: 13 feet.
YIELD: 590 gpm.
SPECIFIC CAPACITY: 45.4 gpm/ft.

PRODUCTION: 2,570,000 gpd, total for wells 26a to 26f.
TEMPERATURE: 60° F.
WATER LEVEL: 50.0 feet below land surface on September 19, 1939.

26d, WOODLAWN WATER CO., Aliquippa. Drilled in 1940 by Ohio Drilling Co.
USAGE: Municipal supply.

SURFACE ELEVATION: 726.0 feet. Top of casing at land surface.
DIAMETER OF CASING: 16 inches. 20 feet of screen at bottom.
DEPTH: 83.0 feet below land surface.

DRILLER'S LOG

	FEET
Fill	0—29
Yellow clay	29—46
Blue clay, sand layers	46—50
Blue clay, and hard pan	50—53
Clay, stones, and hard pan	53—59
Sand, gravel, and clay	59—69
Sand, gravel, clay, and sandrock	69—71
Sand and gravel	71—74
Cemented clay, sand, and stones	74—76
Gravel and sand	76—79
Sand, gravel, and clay	79—83
Shale	83—83 +

CHEMICAL ANALYSIS

Apr. 16, 1940

By MORRIS KNOWLES, INC.

	PARTS PER MILLION *(except color and pH)*
Iron (Fe)	0.1
Manganese (Mn)	0.1
Chloride (Cl)	31
Alkalinity (as $CaCO_3$, Phen.)	5
(as $CaCO_3$, MO)	112
Hardness (as $CaCO_3$)	235
Color	0
Turbidity	0
Hydrogen-ion concentration (pH)	7.6

INSTALLATION: Turbine pump; capacity, 500 gpm; motor, 25 hp.

PUMPING TEST

DATE: 1940.
DURATION: 24 hours.
STATIC LEVEL: 45.7 feet.
DRAWDOWN: 20.5 feet.
YIELD: 575 gpm.
SPECIFIC CAPACITY: 28.0 gpm/ft.

PRODUCTION: 2,570,000 gpd, total for wells 26a to 26f.
TEMPERATURE: 60° F.
WATER LEVEL: 45.7 feet below land surface on February 23, 1940.

26e, WOODLAWN WATER CO., Aliquippa. Drilled in 1942 by Ohio Drilling Co.
USAGE: Municipal supply.

SURFACE ELEVATION: 728.0 feet. Top of casing at land surface.
DIAMETER OF CASING: 20 to 12 inches. 15 feet of screen at bottom.
DEPTH: 80.5 feet below land surface.

DRILLER'S LOG

	FEET
Fill	0—42
Clay	42—49
Clay and gravel	49—59
Sand, gravel, and clay	59—63
Sand and gravel	63—65
Sand, gravel, and clay	69—69
Sand and clay	69—73
Clay and gravel	73—78
Sand and clay	78—80
Shale	80—80 +

INSTALLATION: Turbine pump; capacity, 500 gpm; motor, 25 hp.

PUMPING TEST

DATE: 1942.
DURATION: 24 hours.
STATIC LEVEL: 47 feet.
DRAWDOWN: 15 feet.
YIELD: 600 gpm.
SPECIFIC CAPACITY: 40.0 gpm/ft.

PRODUCTION: 2,570,000 gpd, total for wells 26a to 26f.
TEMPERATURE: 60° F.
WATER LEVEL: 47.0 feet below land surface on March 17, 1942.

26f, WOODLAWN WATER CO., Aliquippa. Drilled in 1945 by Ohio Drilling Co.
USAGE: Municipal supply.

SURFACE ELEVATION: 732.5 feet. Top of casing at land surface.
DIAMETER OF CASING: 16 inches. 20 feet of screen at bottom.
DEPTH: 89.5 feet below land surface.

DRILLER'S LOG

	FEET
Slag fill	0 —48
Dark clay and silt	48 —58
Dark clay and sand	58 —60
Clay and stones	60 —67
Sand, gravel, and clay	67 —82
Sand and gravel	82 —89.5
Shale	89.5—89.5 +

INSTALLATION: Turbine pump; capacity, 500 gpm; motor, 25 hp.

PUMPING TEST

DATE: 1945.
DURATION: 24 hours.
STATIC LEVEL: 52 feet.
DRAWDOWN: 12.5 feet.
YIELD: 745 gpm.
SPECIFIC CAPACITY: 59.6 gpm/ft.

PRODUCTION: 2,570,000 gpd, total for wells 26a to 26f.
TEMPERATURE: 60° F.
WATER LEVEL: 52.0 feet below land surface on October 6, 1944.

26g, WOODLAWN WATER CO., Aliquippa. Drilled in 1949 by Ohio Drilling Co.
USAGE: Municipal supply.

SURFACE ELEVATION: 733 feet. Top of casing at land surface.
DIAMETER OF CASING: 24 to 16 inches. 20 feet of screen at bottom.
DEPTH: 91.0 feet below land surface.

DRILLER'S LOG

	FEET
Slag	0—52
Mud, fine sand	52—58
Clay, sand, stones	58—64
Gravel, sand, clay	64—79
Sand, large gravel, clay	79—84
Gravel, sand	84—89
Gravel, sand, slag	89—91

INSTALLATION: Turbine pump; capacity, 1,000 gpm; motor, 50 hp.

PUMPING TEST

DATE: 1949. DRAWDOWN: 11 feet.
DURATION: 24 hours. YIELD: 1,000 gpm.
STATIC LEVEL: 54 feet. SPECIFIED CAPACITY: 90.9 gpm/ft.

PRODUCTION: 1,440,000 gpd, operating 24 hours/day.
TEMPERATURE: 60° F.
WATER LEVEL: 54.0 feet below land surface May 1949.

26h, WOODLAWN WATER CO., Aliquippa. Drilled in 1942 by Ohio Drilling Co. USAGE: Municipal supply.

SURFACE ELEVATION: 733 feet. Top of casing at land surface.
DIAMETER OF CASING: 24 to 16 inches. 15 feet of screen at bottom.
DEPTH: 80.0 feet below land surface.

DRILLER'S LOG

	FEET
Slag fill	0—35
Silt, sand, mud	35—45
Clay, sand	45—50
Blue clay, sand	50—54
Yellow clay, sand	54—59
Gravel, clay	59—64
Fine sand	64—68
Gravel, sand, clay	68—75
Gravel, sand	75—78
Clay, gravel	78—80

INSTALLATION: None.
PRODUCTION: Abandoned May 1945.
TEMPERATURE: 60° F.

26i, WOODLAWN WATER CO., Aliquippa. Drilled in 1942 by Ohio Drilling Co. USAGE: Municipal supply.

SURFACE ELEVATION: 733 feet. Top of casing at land surface.
DIAMETER OF CASING: 24 to 16 inches. 20 feet of screen at bottom.
DEPTH: 80.0 feet below land surface.

DRILLER'S LOG

	FEET
Fill	0—42
Clay	42—49
Clay, gravel	49—59
Sand, gravel, clay	59—63
Sand, gravel	63—65
Sand, gravel, clay	65—69
Sand, clay	69—73
Gravel, clay	73—78
Sand, clay	78—80

INSTALLATION: None.
PRODUCTION: Abandoned May 1945.
TEMPERATURE: 60° F.

27, JONES AND LAUGHLIN STEEL CO., Aliquippa. Ten wells drilled in 1923, by Pennsylvania Drilling Co. USAGE: Washing, fire protection.

SURFACE ELEVATION: 684 feet. Top of casings below river surface.
DIAMETER OF CASING: 8 inches.
DEPTH: 42 feet below land surface.

CHEMICAL ANALYSIS
Mar. 19, 1947

	PARTS PER MILLION
Iron oxide (Fe_2O_3)	6.5
Manganese oxide (MnO)	3.5
Calcium oxide (CaO)	164
Magnesium oxide (MgO)	20
Sulfite (SO_3)	226
Sulfur dioxide (SO_2)	12
Chloride (Cl)	27
Total solids	556

INSTALLATION: 2 centrifugal pumps; capacity, 500 gpm each; motors, 90 hp.
PRODUCTION: 432,000 gpd, operating 24 hours/day.
TEMPERATURE: 58° F. on March 19, 1947.

28a, SOUTH HEIGHTS WATER CO., South Heights. Drilled in 1924 by Lester McCartney. USAGE: Municipal supply.

SURFACE ELEVATION: 742 feet. Top of casing at land surface.
DIAMETER OF CASING: 8¼ inches.
DEPTH: 97.0 feet below land surface.

CHEMICAL ANALYSIS
(Composite sample from wells 28a and 28b)
Aug. 11, 1942

	PARTS PER MILLION *(except color and pH)*
Iron (Fe)	0.0
Manganese (Mn)	0.0
Magnesium (Mg)	78
Sulfate (SO_4)	105
Chloride (Cl)	49
Alkalinity (as $CaCO_3$)	144
Free CO_2	80
Total solids	470
Total hardness (as $CaCO_3$)	338
Color	0
Ignition loss	105
Turbidity	0
Organic matter	0
Hydrogen-ion concentration (pH)	7.3

INSTALLATION: Turbine pump; capacity, 150 gpm; motor, 10 hp.
PRODUCTION: 76,000 gpd, total for wells 28a and 28b operating alternately.
TEMPERATURE: 57° F.
WATER LEVEL: 59.0 feet below land surface in August 1924.

28b, SOUTH HEIGHTS WATER CO., South Heights. Drilled in 1935 by Chester Bell. USAGE: Municipal supply.

SURFACE ELEVATION: 742 feet. Top of casing at land surface.
DIAMETER OF CASING: 8¼ inches.
DEPTH: 97 feet below land surface.

INSTALLATION: Turbine pump; capacity, 150 gpm; motor, 10 hp.
PRODUCTION: 76,000 gpd, total for wells 28a and 28b operating alternately.
TEMPERATURE: 57° F.
WATER LEVEL: 60 feet below land surface in 1948.

29, STANDARD SPECIALTY AND TUBE CO., New Brighton. USAGE: Drinking.

SURFACE ELEVATION: 730 feet. Top of casing at land surface.
DIAMETER OF CASING: 6 inches.
DEPTH: 74.0 feet below land surface.

INSTALLATION: Turbine pump.
PRODUCTION: 18,000 gpd, operating 12 hours/day.
TEMPERATURE: 52° F.
WATER LEVEL: 59.0 feet below land surface in March 1942.

30, ROCHESTER PIPE PRODUCTS CO., New Brighton. Drilled in 1900. USAGE: Drinking.

SURFACE ELEVATION: 745 feet. Top of casing at land surface.
DIAMETER OF CASING: 6 inches.
DEPTH: 70 feet below land surface.

INSTALLATION: Plunger pump; motor, ½ hp.
PRODUCTION: 7,200 gpd, operating 6 hours/day.
TEMPERATURE: 52° F.
WATER LEVEL: 50 feet below land surface.

31, UNION DRAWN STEEL CO., Beaver Falls. USAGE: Drinking.

SURFACE ELEVATION: 730 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 inches.
DEPTH: 90.0 feet below land surface.

CHEMICAL CHARACTER: Some iron (Fe), manganese (Mn). Unfit for boiler use (too hard.)

INSTALLATION: Turbine pump; capacity, 175 gpm; motor, 20 hp.
PRODUCTION: Not in use at present.
TEMPERATURE: 50° F.
WATER LEVEL: 60 feet below land surface in 1941.

32, FAME LAUNDRIES, INC., Beaver Falls. Drilled in 1908. USAGE: Laundry washing.

SURFACE ELEVATION: 740 feet. Top of casing at land surface.
DIAMETER OF CASING: 5 inches.
DEPTH: 100 feet below land surface.

CHEMICAL ANALYSIS
May 28, 1948
By CONTINENTAL PRODUCTS CO.

	PARTS PER MILLION
Silica (SiO_2)	trace
Iron oxide (Fe_2O_3)	trace
Aluminum oxide (Al_2O_3)	trace
Hardness (as $CaCO_3$)	214

INSTALLATION: Plunger pump; capacity, 100 gpm; motor 5 hp.
PRODUCTION: Not in use at present. Formerly pumped 85 gpm.
TEMPERATURE: 52° F.
WATER LEVEL: 12 feet below land surface.

33, ANDALUSIA DAIRY CO., Beaver Falls. Drilled in 1935 by Al McCormick, USAGE: Cooling.

SURFACE ELEVATION: 740 feet. Top of casing in basement.
DIAMETER OF CASING: 8 inches.
DEPTH: 95 feet below land surface.

CHEMICAL ANALYSIS
June 8, 1943

	PARTS PER MILLION
Silica (SiO_2)	12.4
Iron (Fe)	8.4
Calcium (Ca)	197
Magnesium (Mg)	35.4
Sodium (Na)	73.1
Sulfate (SO_4)	428
Chloride (Cl)	45.8
Total solids	1162
Free CO_2	118.0

INSTALLATION: Turbine pump; capacity, 100 gpm; motor, 5 hp.
PRODUCTION: 9,600 gpd, operating 4 hours/day.
TEMPERATURE: 53° F.
WATER LEVEL: Flowing well.

34, PETROLEUM SOLVENTS CO., Vanport. Drilled in 1946 by Gilkey Bros. USAGE: Refining, washing.

SURFACE ELEVATION: 705 feet. Top of casing at land surface.
DIAMETER OF CASING: 12 to 8 inches.
DEPTH: 75.0 feet below land surface.
AQUIFER: Homewood sandstone, Pottsville series.

DRILLER'S LOG

	FEET
Fill, sand, gravel and clay	0—38
Homewood sandstone, Pottsville series	38—75

INSTALLATION: Centrifugal pump.
PRODUCTION: 6,000 gpd, operating 2 hours/day.
TEMPERATURE: 55° F.
DRAWDOWN: 15 feet at 50 gpm.

35, INDUSTRY SCHOOL, Industry Township. Drilled in 1940 by Gilkey Bros. USAGE: Drinking, sanitation.

SURFACE ELEVATION: 750 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 inches.
DEPTH: 66 feet below land surface.
AQUIFER: Kittanning sandstone, Allegheny group.

INSTALLATION: Centrifugal pump; motor, ¾ hp.
PRODUCTION: 600 gpd.

36, MIDLAND ICE CO., Midland. Drilled in 1920. USAGE: Ice making.

DIAMETER OF CASING: 6 inches.
DEPTH: 175 feet below land surface.
AQUIFER: Vanport limestone (?), Allegheny group.

INSTALLATION: Plunger pump; motor, 5 hp.
PRODUCTION: Not in use at present.

37, KIDD DRAWN STEEL CO., Aliquippa. Drilled in 1917. USAGE: Drinking.

SURFACE ELEVATION: 740 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 inches.
DEPTH: 150 feet below land surface.
AQUIFER: Kittanning sandstone, Allegheny group.

INSTALLATION: Jet-vacuum pump; motor, ¾ hp.
PRODUCTION: 1,500 gpd, operating 8 hours/day.
TEMPERATURE: 58° F.
WATER LEVEL: 36 feet below land surface October 1, 1947.

38, CENTER TOWNSHIP FIRE DEPARTMENT, Center Township. Drilled in 1944 by Gilkey Bros. USAGE: Drinking.

SURFACE ELEVATION: 1,130 feet. Top of casing at land surface.
DIAMETER OF CASING: 6 inches.
DEPTH: 110 feet below land surface.
AQUIFER: Saltsburg sandstone, Conemaugh group.

INSTALLATION: Jet pump; capacity, 4 gpm; motor, 1 hp.
PRODUCTION: Intermittent use operating at 0.25 gpm.
WATER LEVEL: 50 feet below land surface.

39, ALIQUIPPA ICE CO., Aliquippa. Drilled in 1933 by John Bell. USAGE: Condenser cooling.

SURFACE ELEVATION: 840 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 inches.
DEPTH: 100 feet below land surface.
AQUIFER: Butler sandstone, Allegheny group.

INSTALLATION: Turbine pump; capacity, 300 gpm; motor, 15 hp.
PRODUCTION: 50,000 gpd, operating 18 hours/day. (Temporarily abandoned.)
TEMPERATURE: 50° F.

40a, SUTHERLAND DAIRY CO., Aliquippa. Drilled in 1940. USAGE: Cooling.

DIAMETER OF CASING: 8 inches.
DEPTH: 210 feet below land surface.
AQUIFER: Butler or Freeport sandstone, Allegheny group.

INSTALLATION: Centrifugal pump; motor, 5 hp.
PRODUCTION: 14,400 gpd, operating 6 hours/day.
TEMPERATURE: 54° F.

40b, SUTHERLAND DAIRY CO., Aliquippa. Drilled in 1949 by Chester Bell. USAGE: Cooling.

SURFACE ELEVATION: 900 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 inches.
DEPTH: 210 feet below land surface.
AQUIFER: Butler or Freeport sandstone, Allegheny group.

INSTALLATION: Centrifugal pump; motor, 5 hp.
PRODUCTION: Alternate use.
TEMPERATURE: 54° F.

41, ALIQUIPPA GOLF CLUB, Hopewell Township. Drilled in 1940 by Gilkey Bros. USAGE: Drinking, washing.

SURFACE ELEVATION: 820 feet. Top of casing at land surface.
DIAMETER OF CASING: 10 inches.
DEPTH: 65 feet below land surface.
AQUIFER: Butler sandstone, Allegheny group.

INSTALLATION: Jet pump; capacity, 4 gpm; motor, 1 hp.
PRODUCTION: 1,500 gpd, operating 6 hours/day.
WATER LEVEL: 22 feet below land surface.

42, PETTIBON DAIRY CO., Rochester. Drilled in 1947 by Russell Cable. USAGE: Cooling.

SURFACE ELEVATION: 860 feet. Top of casing at land surface.
DIAMETER OF CASING: 12 inches.
DEPTH: 90 feet below land surface.
AQUIFER: Freeport sandstone, Allegheny group.

INSTALLATION: None, well abandoned.
PRODUCTION: 10,000 gpd, operating 18 hours/day. (Not in use.)
WATER LEVEL: 25 feet below land surface, August 1947.

43, PITTSBURGH BRIDGE AND IRON WORKS, Rochester. Drilled in 1919. USAGE: Drinking.

SURFACE ELEVATION: 920 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 inches to depth of 27.5 feet.
DEPTH: 105 feet below land surface.
AQUIFER: Butler sandstone, Allegheny group.

INSTALLATION: Plunger pump; motor, 2 hp.
PRODUCTION: 7,200 gpd, operating 8 hours/day.
WATER LEVEL: 45 feet below land surface.

44, WILLIAM LEARD CO., New Brighton. Drilled in 1900. USAGE: Drinking.

SURFACE ELEVATION: 745 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 inches.
DEPTH: 150 feet below land surface.
AQUIFER: Homewood sandstone, Pottsville series.

INSTALLATION: Plunger pump.
PRODUCTION: 2,500 gpd, operating 1 hour/day.

45, STERLING BORAX CO., New Brighton. Drilled in 1900. USAGE: Drinking, washing.

SURFACE ELEVATION: 780 feet. Top of casing at land surface.
DIAMETER OF CASING: 6 inches.
DEPTH: 180 feet below land surface.
AQUIFER: Homewood sandstone, Pottsville series.

INSTALLATION: Plunger pump.
PRODUCTION: Not in use (former pumpage, 10,000 gpd).

46, BRIGHTON FIRE BRICK CO., New Brighton. Drilled in 1900. USAGE: Boilers, general plant use.

SURFACE ELEVATION: 800 feet. Top of casing at land surface.
DIAMETER OF CASING: 4 inches.
DEPTH: 175 feet below land surface.
AQUIFER: Homewood sandstone, Pottsville series.

INSTALLATION: Plunger pump.
PRODUCTION: Not in use at present.

47a, MAYER CHINA CO., Beaver Falls. Drilled in 1946 by Gilkey Bros. USAGE: Clay mixing.

SURFACE ELEVATION: 740 feet. Top of casing at land surface.
DIAMETER OF CASING: 12 inches to 10.5 feet.
DEPTH: 50.0 feet below land surface (bedrock at 10 feet).
AQUIFER: Homewood sandstone, Pottsville series.

INSTALLATION: Jet pump; motor, ½ hp.
PRODUCTION: 7,200 gpd, operating 8 hours/day.
WATER LEVEL: 45 feet below land surface.

47b, MAYER CHINA CO., Beaver Falls. Drilled in 1946 by Gilkey Bros. USAGE: Clay mixing.

SURFACE ELEVATION: 740 feet. Top of casing at land surface.
DIAMETER OF CASING: 12 inches to 11 feet.
DEPTH: 50.0 feet below land surface.
AQUIFER: Homewood sandstone, Pottsville series.

INSTALLATION: Jet pump; motor, 1.5 hp.
PRODUCTION: 9,600 gpd, operating 8 hours/day.
WATER LEVEL: 45 feet below land surface.

47c, MAYER CHINA CO., Beaver Falls. Drilled in 1946 by Gilkey Bros. USAGE: Clay mixing.

SURFACE ELEVATION: 740 feet. Top of casing at land surface.
DIAMETER OE CASING: 12 inches to 11 feet.
DEPTH: 50.0 feet below land surface.
AQUIEER: Homewood sandstone, Pottsville series.

INSTALLATION: Jet pump; motor, 1.5 hp.
PRODUCTION: 9,600 gpd, operating 8 hours/day.
WATER LEVEL: 45 feet below land surface.

47d, MAYER CHINA CO., Beaver Falls. Drilled in 1947 by Gilkey Bros. USAGE: Color grinding.

SURFACE ELEVATION: 740 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 inches to 10.75 feet.
DEPTH: 35.0 feet below land surface.
AQUIFER: Homewood sandstone, Pottsville series.

INSTALLATION: Jet pump; motor, ¾ hp.
PRODUCTION: 9,600 gpd, operating 8 hours/day.
WATER LEVEL: 45 feet below land surface.

47e, MAYER CHINA CO., Beaver Falls. Drilled in 1948 by Gilkey Bros. USAGE: Clay mixing.

SURFACE ELEVATION: 740 feet. Top of casing at land surface.
DIAMETER OF CASING: 12 inches to 10 feet.
DEPTH: 51.0 feet below land surface.
AQUIFER: Homewood sandstone, Pottsville series.

INSTALLATION: Jet pump; motor, 1½ hp.
PRODUCTION: 9,600 gpd, operating 8 hours/day.
WATER LEVEL: 45 feet below land surface.

48a, BRODHEAD HOTEL, Beaver Falls. Drilled in 1926. USAGE: Drinking, air conditioning.

SURFACE ELEVATION: 810 feet. Top of casing in basement.
DIAMETER OF CASING: 6 inches.
DEPTH: 125 feet below land surface.
AQUIFER: Homewood sandstone, Pottsville series.

INSTALLATION: Centrifugal pump; capacity, 30 gpm; motor, 5 hp.
PRODUCTION: 32,400 gpd, operating 18 hours/day.
TEMPERATURE: 62° F.
WATER LEVEL: 80 feet below land surface May 1948.

48b, BRODHEAD HOTEL, Beaver Falls. Drilled in 1926. USAGE: Drinking, air conditioning.

SURFACE ELEVATION: 810 feet. Top of casing in basement.
DIAMETER OF CASING: 6 inches.
DEPTH: 125 feet below land surface.
AQUIFER: Homewood sandstone, Pottsville series.

INSTALLATION: Centrifugal pump; capacity, 30 gpm; motor, 5 hp.
PRODUCTION: 32,400 gpd, operating 18 hours/day.
TEMPERATURE: 62° F.
WATER LEVEL: 80 feet below land surface May 1948.

49a, FRUMEN'S DAIRY, Big Beaver Township. Drilled in 1941 by George Dillan. USAGE: Cooling, drinking, washing.

SURFACE ELEVATION: 920 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 inches to 20 feet.
DEPTH: 105 feet below land surface.
AQUIFER: Homewood sandstone, Pottsville series.

INSTALLATION: Turbine pump; capacity, 50 gpm; motor, 3 hp.
PRODUCTION: 15,000 gpd, operating 5 hours/day.
WATER LEVEL: 70 feet below land surface.

49b, FRUMEN'S DAIRY, Big Beaver Township. Drilled in 1944 by George Dillan. USAGE: Cooling, drinking, washing.

SURFACE ELEVATION: 920 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 inches.
DEPTH: 105 feet below land surface.
AQUIFER: Homewood sandstone, Pottsville series.

INSTALLATION: Turbine pump; capacity, 50 gpm; motor, 3 hp.
PRODUCTION: 6,000 gpd, operating 2 hours/day.
WATER LEVEL: 70 feet below land surface.

50a, KOPPEL BOROUGH, Koppel. Drilled about 1920. USAGE: Municipal supply.

SURFACE ELEVATION: 920 feet. Top of casing at land surface.
DIAMETER OF CASING: 6 inches.
DEPTH: 76 feet below land surface.
AQUIFER: Homewood sandstone, Pottsville series.

INSTALLATION: Turbine pump; capacity, 50 gpm; motor, 5 hp.
PRODUCTION: 25,000 gpd, operating 9 hours/day.
WATER LEVEL: 38 feet below land surface.

50b, KOPPEL BOROUGH, Koppel. Drilled in 1943 by Bradshaw and Modro Drilling Co. USAGE: Municipal supply.

SURFACE ELEVATION: 960 feet. Top of casing at land surface.
DIAMETER OF CASING: 8 inches.
DEPTH: 60 feet below land surface.
AQUIFER: Lower part of Allegheny group.

INSTALLATION: Turbine pump; capacity, 50 gpm; motor, 3.5 hp.
PRODUCTION: Emergency stand-by well for 44a.
WATER LEVEL: 12 feet below land surface.

51, ELLWOOD STONE CO., Koppel. Drilled in 1945 by Bradshaw and Modro Drilling Co. USAGE: Drinking.

SURFACE ELEVATION: 860 feet. Top of casing at land surface.
DIAMETER OF CASING: 6 inches.
DEPTH: 50 feet below land surface.
AQUIFER: Upper Connoquenessing sandstone, Pottsville series.
CHEMICAL CHARACTER: High in iron (Fe).

INSTALLATION: Plunger pump. Manually operated.
PRODUCTION: Tested at 50 gpm.
WATER LEVEL: 20 feet below land surface.

52, CAMP KON-O-KWEE (YMCA), Marion Township. Drilled in 1941 by Gilkey Bros. USAGE: Drinking, sanitation.

SURFACE ELEVATION: 925 feet.
DIAMETER OF CASING: 8 inches.
DEPTH: 102 feet below land surface.
AQUIFER: Vanport limestone, Allegheny group.

INSTALLATION: Jet pump; capacity, 30 gpm.
PRODUCTION: 12,500 gpd, in camp season.
WATER LEVEL: 35 feet below land surface, March 1941.

53, NEW CASTLE REFRACTORIES, New Galilee. Drilled in 1920 by Tom Gilkey. USAGE: Boiler water.

SURFACE ELEVATION: 970 feet. Top of casing at land surface.
DIAMETER OF CASING: 6 inches.
DEPTH: 180 feet below land surface.
AQUIFER: Lower Allegheny group.

INSTALLATION: Turbine pump.
PRODUCTION: 6,000 gpd, operating 10 hours/day.
WATER LEVEL: 80 feet below land surface in 1947.

54, MALVERN FIREPROOFING CORP., Darlington Township. Drilled in 1949 by George Dillan. USAGE: Clay mixing, drinking.

SURFACE ELEVATION: 830 feet. Top of casing 3 feet below land surface.
DIAMETER OF CASING: 8 inches.
DEPTH: 35 feet below land surface.

INSTALLATION: Centrifugal pump; capacity, 16 gpm; motor, 2 hp.
PRODUCTION: 6,000 gpd.
WATER LEVEL: 15 feet below land surface.

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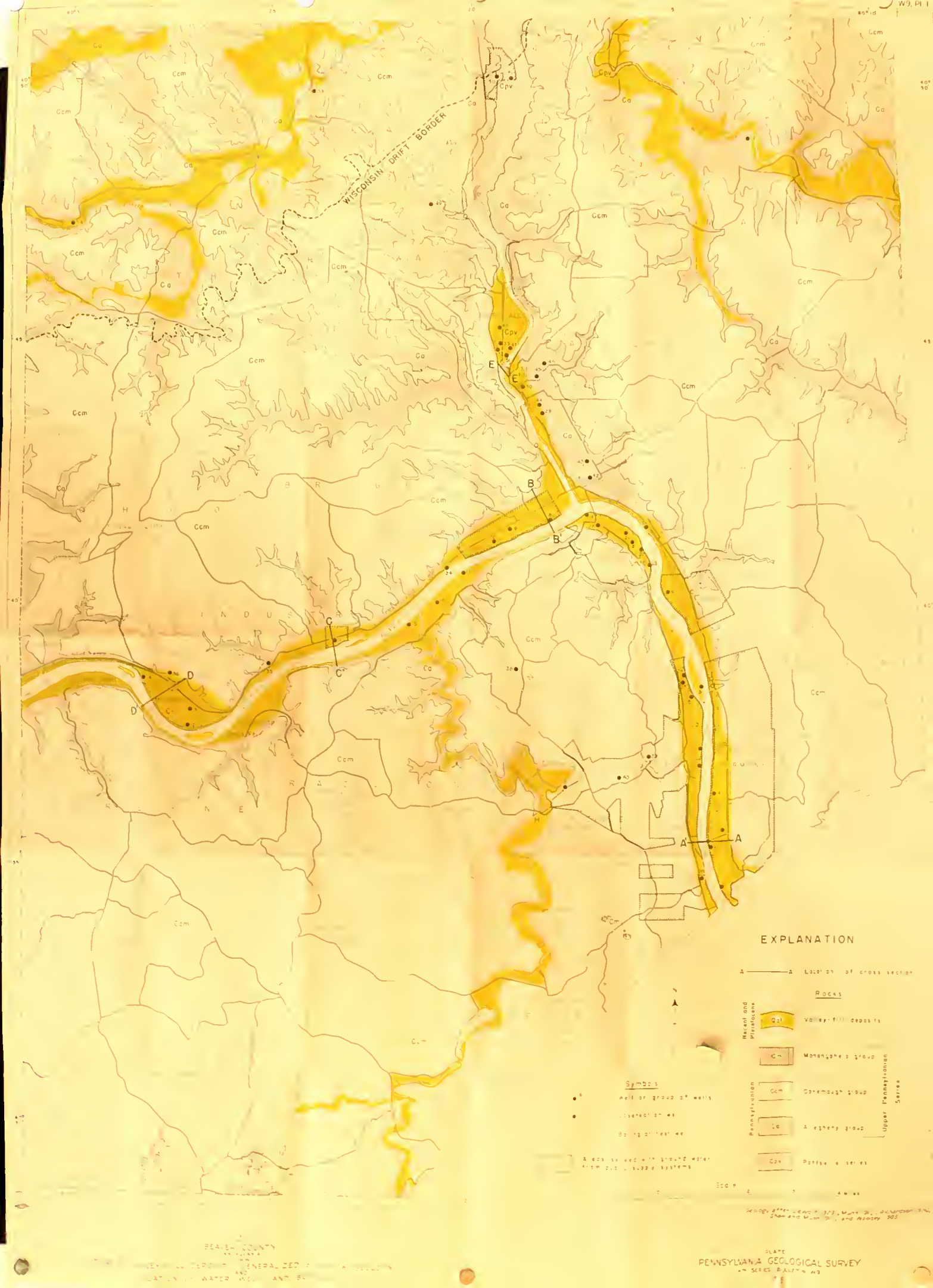

BEAVER COUNTY

PLATE

PENNSYLVANIA GEOLOGICAL SURVEY